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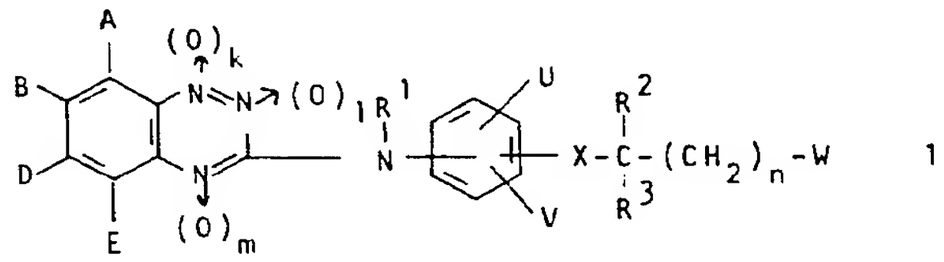
(54) **1,2,4-Benzotriazinylaminophenoxyalkane carboxylic acid derivatives, processes for their preparation, their use as herbicides, intermediates and their preparation.**

(57) The invention concerns novel compounds of the formula I



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The compounds are herbicides and in further embodiments the invention provides processes for the preparation of compounds of formula I, intermediates useful in the preparation of compounds of formula I, herbicidal composition containing as active ingredient a compound of formula I, and processes for severely damaging or killing unwanted plants by applying to the plants or to the growth medium of the plants an effective amount of a compound of formula I.

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TITLE MODIFIED
see front page

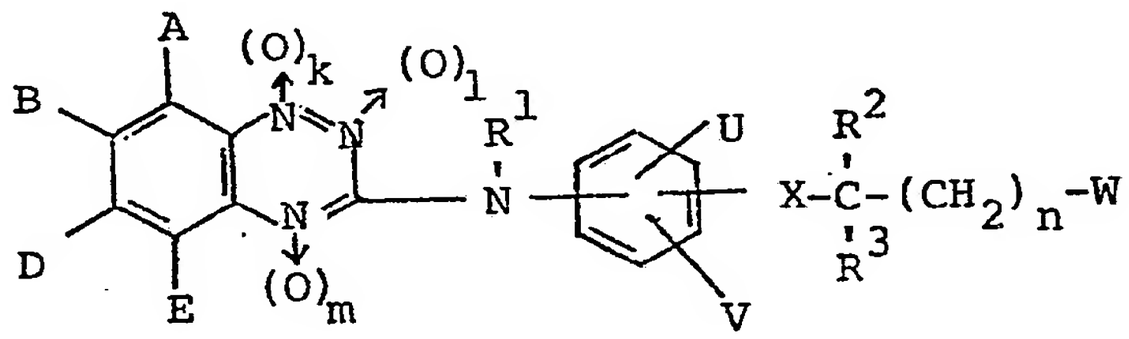
TITLE

1,2,4-BENZOTRIAZINYLOXYPHENOXYALKANE CARBOXYLIC ACID DERIVATIVES AND THEIR USE AS HERBICIDES.

This invention relates to organic compounds having biological activity and in particular to organic compounds having herbicidal properties, to processes for the preparation of such compounds, to intermediates useful in the preparation of such compounds and to herbicidal compositions and processes utilizing such compounds.

We have now found a new class of benzotriazines which exhibit biological activity, and in particular herbicidal activity.

Accordingly the invention provides a compound of formula I:



I

or a salt thereof wherein:

A, B, D, E, U and V are independently chosen from the group consisting of hydrogen, halogen, nitro, cyano, thiocyano, amino, C_1 to C_6 alkylamino, di(C_1 to C_6 alkyl)amino, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl, C_2 to C_6 alkenyl, C_3 to C_7 cycloalkyl, C_1 to C_6 alkoxy, C_1 to C_6 haloalkoxy, C_1 to C_6 alkylthio, C_1 to C_6 alkylsulfinyl, C_1 to C_6 alkylsulfonyl, C_1 to C_6 haloalkylsulfinyl, C_1 to C_6 haloalkylsulfonyl, sulfo, C_1 to C_6 alkoxysulfonyl, sulfamoyl, N-(C_1 to C_6 alkyl)sulfamoyl, N,N-di(C_1 to C_6 alkyl)sulfamoyl, carboxy, (C_1 to C_6 alkoxy)-carbonyl, carbamoyl, N-(C_1 to C_6 alkyl)carbamoyl, N,N-di(C_1 to C_6 alkyl)carbamoyl, phenyl, phenoxy, phenylthio, and the groups substituted phenyl, substituted

phenoxy and substituted phenylthio wherein in each group the phenyl ring is substituted with from 1 to 3 substituents chosen from the group consisting of halogen, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl, C_1 to C_6 alkoxy, nitro and cyano;

R^1 is chosen from the group consisting of hydrogen, C_1 to C_{10} alkyl, C_2 to C_{10} alkenyl, C_2 to C_{10} alkynyl, C_2 to C_{10} alkoxyalkyl, cyanomethylene, (C_1 to C_6 alkoxy)-carbonylmethylene, C_1 to C_{10} haloalkyl, formyl, C_2 to C_{10} alkanoyl, phenyl, benzyl, benzoyl, and the groups phenyl, benzyl and benzoyl wherein in each group the phenyl ring is substituted with from 1 to 3 substituents chosen from the group consisting of halogen, C_1 to C_6 alkyl, C_1 to C_6 halo-alkyl, C_1 to C_6 alkoxy, nitro and cyano;

R^2 is chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkenyl, C_2 to C_6 alkoxyalkyl, C_1 to C_6 haloalkyl, acetyl, propionyl and C_2 to C_6 alkoxycarbonyl;

R^3 is chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkenyl, C_2 to C_6 alkoxyalkyl and C_1 to C_6 haloalkyl, or R^2 and R^3 together may form a methylene, ethylidene, propylidene or isopropylidene group;

W is chosen from the group consisting of cyano, thio-carbamoyl, $-\overset{O}{\overset{\|}{C}}-G$ and CH_2Z wherein: G is chosen from the group consisting of hydroxy, mercapto, C_1 to C_{10} alkoxy, C_1 to C_{10} haloalkoxy, C_2 to C_{10} alkenyloxy, C_2 to C_{10} alkynyloxy, C_1 to C_{10} alkylthio, C_2 to C_{10} alkenylthio, C_2 to C_{10} alkynylthio, C_3 to C_7 cyclo-alkoxy, C_3 to C_7 cycloalkoxy substituted with 1 or 2 C_1 to C_4 alkyl groups, phenoxy, phenylthio, benzyloxy, benzylthio, the group C_1 to C_6 alkoxy substituted with a substituent chosen from the group consisting of C_1 to C_6

alkoxy, amino, ammonio, cyano, N-(C_1 to C_6 alkyl)amino, N,N-di(C_1 to C_6 alkyl)amino and N,N,N-tri-(C_1 to C_6 alkyl) ammonio, the groups phenoxy, phenylthio, benzyloxy and benzylthio wherein in each group the phenyl ring is substituted with from 1 to 3 substituents chosen from the group consisting of halogen, nitro, cyano, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl and C_1 to C_6 alkoxy, the group OM wherein M is the cation of an inorganic or organic base, the group $-NHSO_2R^4$ wherein R^4 is chosen from C_1 to C_{10} alkyl and C_1 to C_{10} haloalkyl, and the group $-NR^5R^6$ wherein R^5 and R^6 are independently chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_1 to C_6 hydroxyalkyl, C_1 to C_6 haloalkyl, phenyl and benzyl, or R^5 and R^6 together form a heterocyclic ring, and the group $-O-N=R^{10}$ wherein R^{10} is a C_1 to C_{10} alkylidene group; and Z is chosen from halogen, hydroxy, mercapto, C_1 to C_{10} alkoxy, C_1 to C_{10} haloalkoxy, C_1 to C_{10} alkylthio, and the group NR^5R^6 wherein R^5 and R^6 are as hereinbefore defined;

X is chosen from oxygen and sulfur;
k, l and m are independently chosen from 0 and 1 provided that k+l+m is 0, 1 or 2; and n is 0, 1 or 2.

The compounds of formula I wherein R^2 and R^3 are not the same, are optically active and the present invention also includes the individual stereo isomers of such compounds, and mixtures of those stereo isomers in addition to the racemic mixture of stereo isomers.

Suitable A, B, D, E, U and V include hydrogen, halogen, nitro, cyano, thiocyano, amino optionally substituted with one or two C_1 to C_6 alkyl groups, C_1 to C_6 alkyl optionally substituted with one or more halogen atoms, C_2 to C_6 alkenyl, C_3 to C_7 cycloalkyl, C_1 to C_6 alkoxy, C_1 to C_6 alkylthio, C_1 to C_6 alkylsulfinyl, C_1 to C_6 alkylsulfonyl, carbalkoxy wherein alkoxy is a C_1 to C_6 alkoxy group, and the groups phenyl, phenoxy or phenylthio wherein in each the phenyl ring is

optionally substituted with from one to three substituents chosen from halogen, C_1 to C_6 haloalkyl, C_1 to C_6 alkyl, C_1 to C_6 alkoxy, nitro and cyano.

Suitable R^1 include hydrogen, C_1 to C_{10} alkyl, C_2 to C_{10} alkenyl, C_2 to C_{10} alkoxyalkyl, C_1 to C_{10} haloalkyl, formyl, C_2 to C_{10} alkanoyl and the groups phenyl, benzyl and benzoyl each optionally substituted in the phenyl ring with one or two substituents chosen from halogen, nitro, cyano, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl and C_1 to C_6 alkoxy.

Suitable R^2 include hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkenyl, C_2 to C_6 alkoxyalkyl, C_1 to C_6 haloalkyl, acetyl, propionyl and C_2 to C_6 alkoxycarbonyl. Suitable R^3 include hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkenyl, C_2 to C_6 alkoxyalkyl and C_1 to C_6 haloalkyl, or R^2 and R^3 together may form a methylene, ethylidene, propylidene or isopropylidene group.

Suitable W include cyano, thiocarbamoyl, $-\overset{O}{\overset{\|}{C}}-G$ and CH_2Z wherein: G is chosen from the group consisting of hydroxy, mercapto, C_1 to C_{10} alkoxy optionally substituted with halogen, hydroxy or C_1 to C_6 alkoxy, C_1 to C_{10} alkylthio, C_2 to C_{10} alkenyloxy, C_2 to C_{10} alkynyloxy, C_2 to C_{10} alkenylthio, C_3 to C_7 cycloalkoxy optionally substituted with one or two C_1 to C_4 alkyl groups, the groups phenoxy, phenylthio, benzyloxy and benzylthio each optionally substituted in the phenyl ring with one or two substituents chosen from halogen, nitro, cyano, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl and C_1 to C_6 alkoxy, the group OM wherein M is the cation of an inorganic or organic base, the group $-NHSO_2R^4$ wherein R^4 is chosen from C_1 to C_{10} alkyl and C_1 to C_6 haloalkyl, and the group $-NR^5R^6$ wherein R^5 and R^6 are independently chosen from the group consisting of hydrogen, C_1 to C_6 alkyl optionally substituted with halogen or hydroxy, phenyl and benzyl, or R^5 and R^6 together form a heterocyclic ring; and Z is chosen from halogen, hydroxy,

mercapto, C_1 to C_{10} alkoxy optionally substituted with halogen, C_1 to C_{10} alkylthio and the group NR^5R^6 wherein R^5 and R^6 are as hereinbefore defined.

Suitable k, l and m include 0 or 1 wherein k+l+m is 0 or 1.

Preferred A, B, D and E include hydrogen, halogen, nitro, cyano, amino, C_1 to C_6 alkylamino, di(C_1 to C_6 alkyl)amino, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl, C_2 to C_6 alkenyl, C_1 to C_6 alkoxy, C_1 to C_6 haloalkoxy, C_1 to C_6 alkylthio, carboxy and (C_1 to C_6 alkoxy)carbonyl.

Preferred U and V include hydrogen, halogen, nitro, cyano, C_1 to C_6 alkyl and C_1 to C_6 haloalkyl.

Preferred R^1 include hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkenyl, C_2 to C_6 alkynyl, benzyl, (C_1 to C_6 alkoxy)carbonylmethylene and cyanomethylene.

Preferred R^2 include hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkoxyalkyl and (C_1 to C_6 alkoxy)carbonyl.

Preferred R^3 include hydrogen and C_1 to C_6 alkyl.

Preferred W include the groups:

a) $-\overset{O}{\overset{\|}{C}}-G$ wherein G is chosen from the group consisting of hydroxy, C_1 to C_{10} alkoxy, C_1 to C_{10} haloalkoxy, C_2 to C_{10} alkenyloxy, C_2 to C_{10} alkynyloxy, C_1 to C_{10} alkylthio, C_2 to C_{10} alkenylthio, C_2 to C_{10} alkynylthio, phenoxy, benzyloxy, cyclohexyloxy, the group C_1 to C_{10} alkoxy substituted with a substituent chosen from the group consisting of C_1 to C_6 alkoxy, amino, N-(C_1 to C_6 alkyl)amino, N,N-di(C_1 to C_6 alkyl)amino and N,N,N-tri(C_1 to C_6 alkyl)ammonio, the group NR^5R^6 wherein R^5 and R^6 are independently chosen from hydrogen C_1 to C_6 alkyl, C_1 to C_6 hydroxyalkyl, C_1 to C_6 haloalkyl, and phenyl, the group OM wherein M is an alkali metal ion, alkaline earth metal ion or an ammonium ion

$H\overset{\oplus}{N}R^7R^8R^9$ wherein R^7, R^8 and R^9 are independently chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_1 to C_6 hydroxyalkyl, phenyl and benzyl, the group $-NHSO_2R^4$ wherein R^4 is C_1 to C_6 alkyl, and the group $-O-N=R^{10}$ wherein R^{10} is a C_1 to C_{10} alkylidene group; and

b) the group $-CH_2Z$ wherein Z is chosen from the group consisting of halogen, hydroxy, mercapto, C_1 to C_{10} alkoxy, and the group $-NR^5R^6$ wherein R^5 and R^6 are independently chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_1 to C_6 hydroxyalkyl, C_1 to C_6 haloalkyl and phenyl.

Preferred X is oxygen and preferred n is 0 or 2.

More preferably:

A, B, D and E are independently chosen from hydrogen, halogen, C_1 to C_6 alkyl, C_1 to C_6 alkoxy and C_1 to C_6 haloalkyl;

U and V are independently chosen from hydrogen and halogen;

R^1 is chosen from hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkynyl, benzyl, (C_1 to C_6 alkoxy)carbonylmethylene and cyanomethylene;

R^2 is chosen from hydrogen, C_1 to C_6 alkyl and C_2 to C_6 alkoxyalkyl;

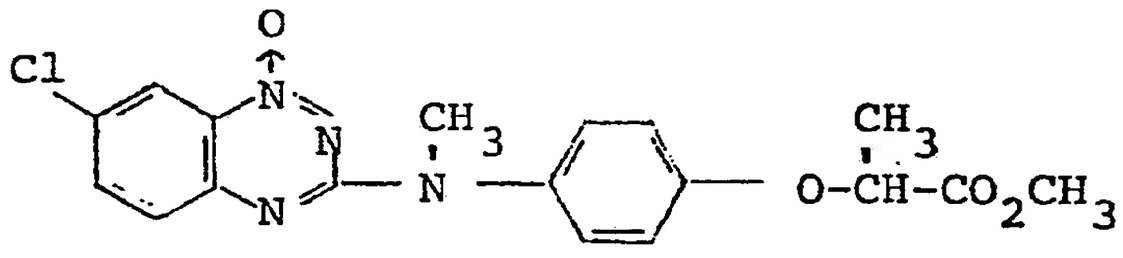
R^3 is chosen from hydrogen and C_1 to C_6 alkyl;

W is the group $-\overset{O}{\overset{\|}{C}}-G$ wherein G is chosen from hydroxy, C_1 to C_{10} alkoxy, C_2 to C_{10} alkenyloxy, C_2 to C_{10} alkynyloxy, C_1 to C_{10} alkylthio, C_1 to C_{10} haloalkoxy, the group C_1 to C_{10} alkoxy substituted with a substituent chosen from amino, N-(C_1 to C_6 alkyl)amino, N,N-di(C_1 to C_6 alkyl)amino and N,N,N-tri(C_1 to C_6 alkyl)ammonio, the group OM wherein M is an alkali

metal ion or an alkaline earth metal ion, the group $-O-N=R^{10}$ wherein R^{10} is a C_1 to C_{10} alkylidene group, and the group $-NR^5R^6$ wherein R^5 and R^6 are independently chosen from hydrogen, C_1 to C_6 alkyl, C_1 to C_6 hydroxyalkyl and C_1 to C_6 haloalkyl;

m is 0, k and l are independently chosen from 0 and 1 and k+l is 0 or 1; and

n is 0.



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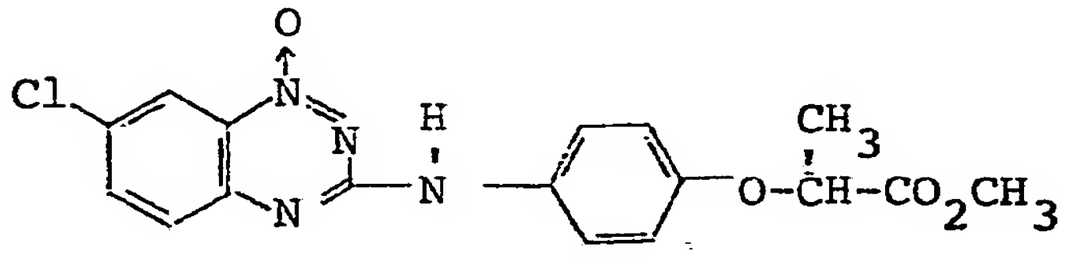

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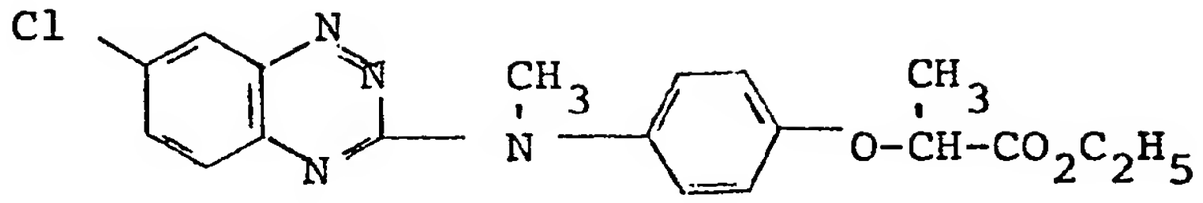

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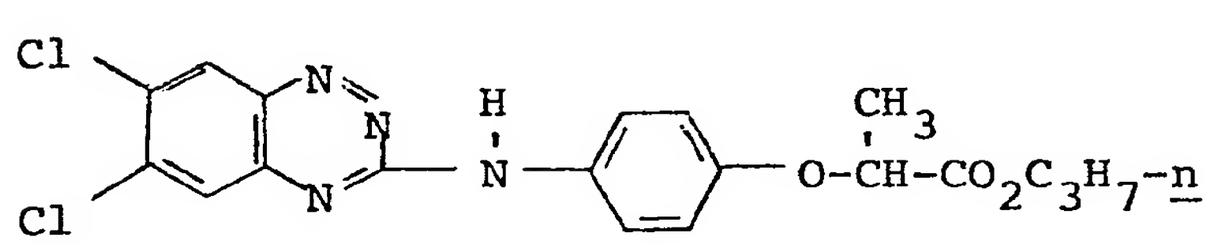

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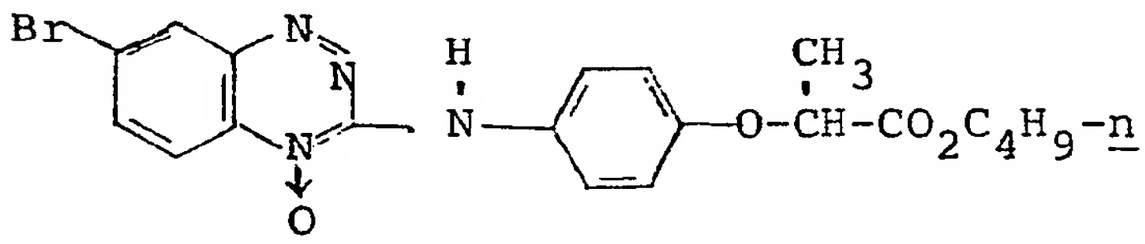

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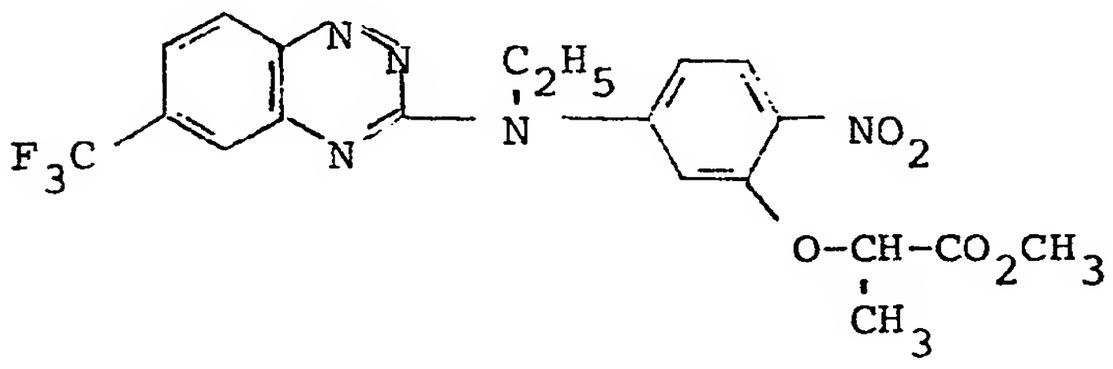

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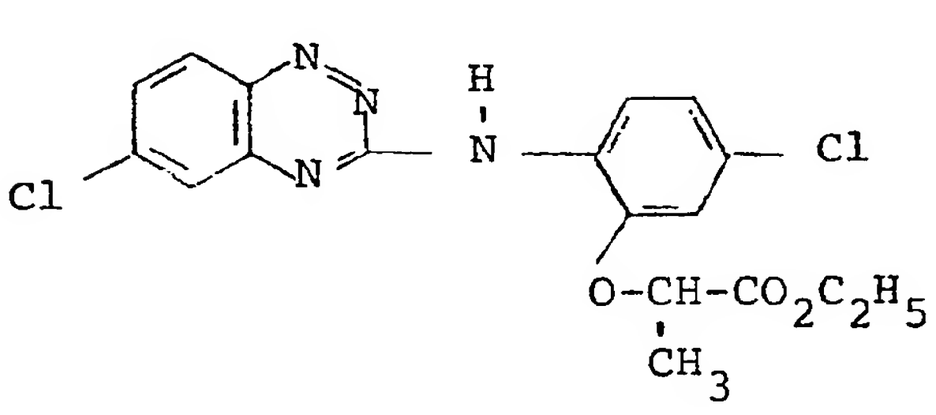

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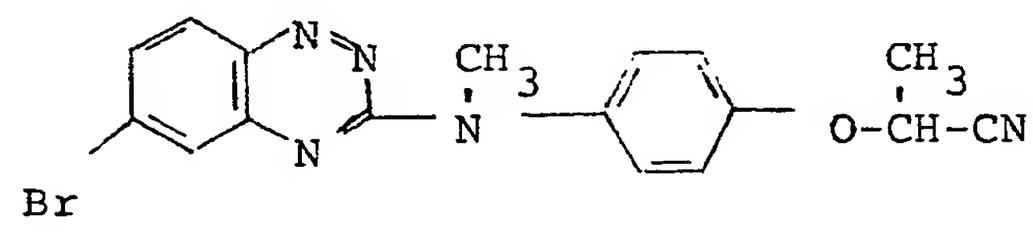

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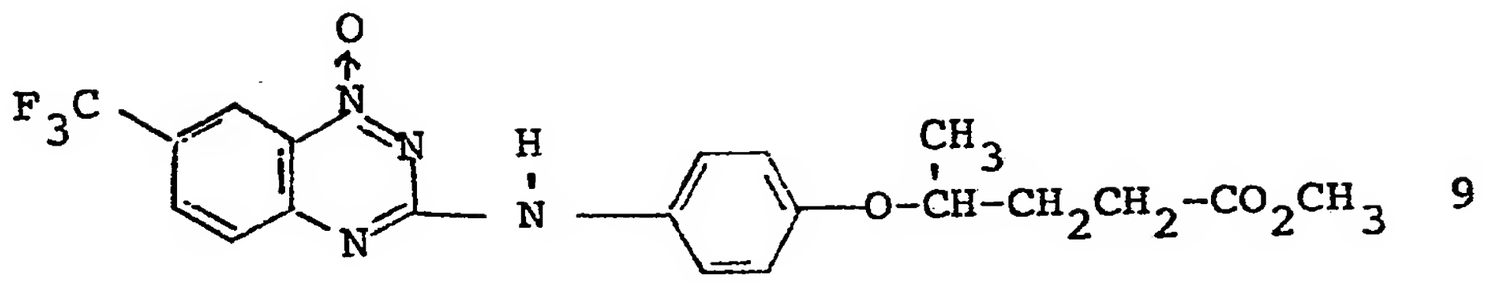

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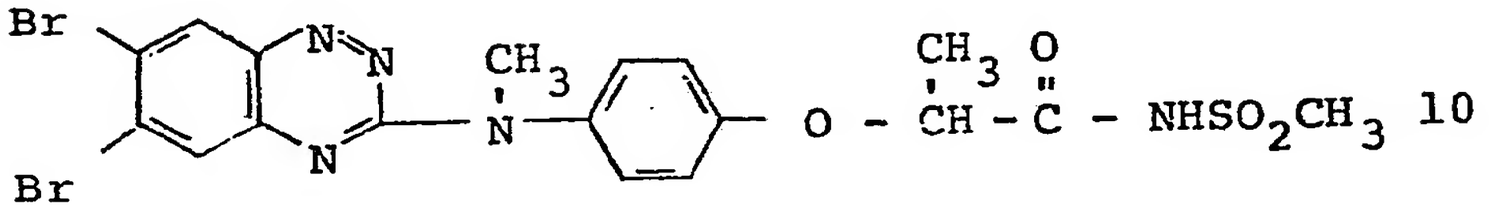

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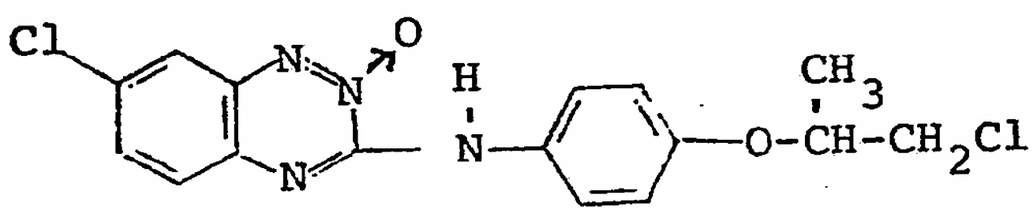

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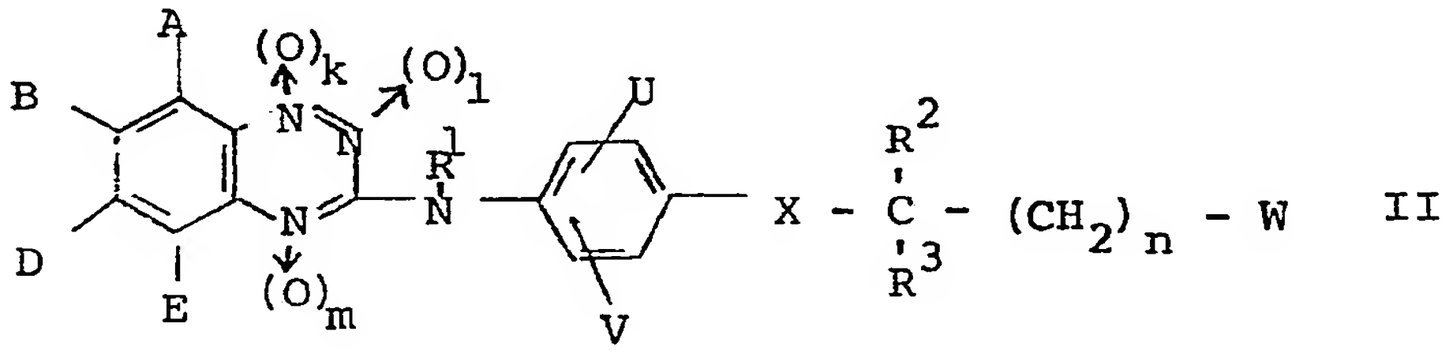
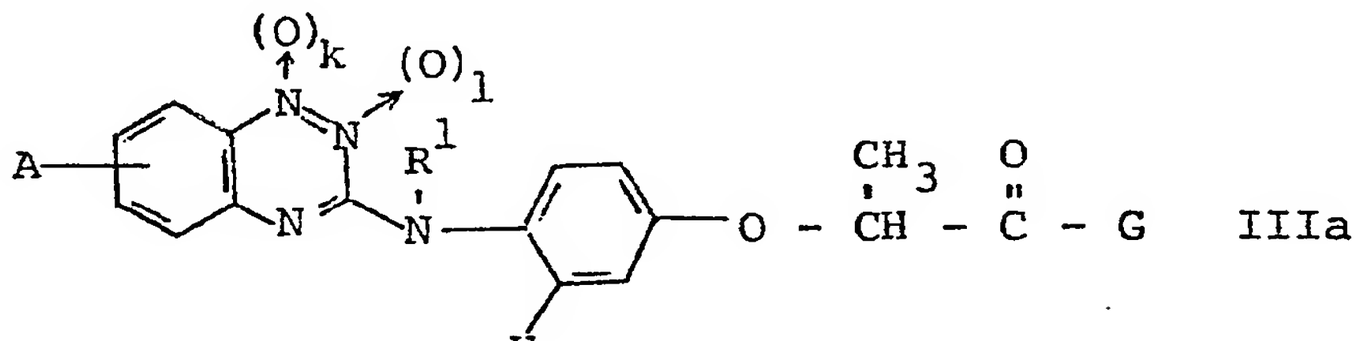
Preferred compounds of formula I are those compounds in which the phenyl ring is 1,4-substituted, that is compounds of formula II



II

Particular examples of compounds of the invention are detailed in Tables 1, 2, 3 and 4 below.

TABLE 1



IIIa

U

Compound No	Substituents					
	A	k	l	R^1	U	G
1	7-Cl	1	0	CH_3	H	CH_3O
2	7-Cl	1	0	H	H	CH_3O
3	7-Cl	0	0	CH_3	H	CH_3O
12	7-Cl	0	0	H	H	CH_3O
13	H	1	0	CH_3	H	C_2H_5O
14	7-CH_3	1	0	CH_3	H	C_2H_5O
15	7-F	1	0	CH_3	H	C_2H_5O
16	7-CH_3O	1	0	CH_3	H	C_2H_5O
17	7-Br	1	0	CH_3	H	C_2H_5O
18	7-Cl	1	0	CH_3	H	C_2H_5O
19	7-CF_3	1	0	CH_3	H	C_2H_5O
20	7-F	0	0	CH_3	H	C_2H_5O
21	7-Cl	0	0	CH_3	H	C_2H_5O
22	6-Cl	1	0	CH_3	H	C_2H_5O
23	6-Cl	0	0	CH_3	H	C_2H_5O
24	7-Cl	0	0	n-C_4H_9	H	C_2H_5O
25	7-Cl	0	0	C_2H_5	H	C_2H_5O
26	7-Cl	0	0	$C_6H_5CH_2$	H	C_2H_5O
27	7-CH_3	0	0	CH_3	H	C_2H_5O

TABLE 1 (Continued)

Compound No	Substituents					
	A	k	l	R^1	U	G
28	7-Cl	0	0	CH_3	H	HO
29	7-Br	0	0	CH_3	H	C_2H_5O
30	7-Cl	0	0	$CH_2C{\equiv}CH$	H	C_2H_5O
31	7-Cl	0	0	$CH_2CO_2CH_3$	H	C_2H_5O
32	7-Cl	0	0	CH_2CN	H	C_2H_5O
33	7-Cl	0	0	CH_3	H	$(CH_3)_2CHCH_2O$
34	7-Cl	0	0	CH_3	H	$2\text{-}C_3H_7O$
35	7-Cl	0	0	CH_3	H	$n\text{-}C_4H_9O$
36	7-Cl	0	0	CH_3	H	$n\text{-}C_3H_7O$
37	7-Cl	0	0	CH_3	H	NaO
38	7-Cl	0	0	CH_3	H	$CH_2{=}CHCH_2O$
39	7-Cl	0	0	CH_3	H	$CH{\equiv}CCH_2O$
40	7-Cl	1	0	CH_3	H	$n\text{-}C_3H_7O$
41	7-Cl	1	0	CH_3	H	$2\text{-}C_3H_7O$
42	7-Cl	1	0	CH_3	H	$n\text{-}C_4H_9O$
43	7-Cl	1	0	CH_3	H	$(CH_3)_2CHCH_2O$
44	7-Cl	1	0	CH_3	H	HO
45	7-Cl	1	0	CH_3	H	NaO
46	7-Cl	1	0	CH_3	H	$CH_2{=}CHCH_2O$
47	7-Cl	1	0	CH_3	H	$CH{\equiv}CCH_2O$
48	$7\text{-}CF_3$	0	0	CH_3	H	C_2H_5O
49	7-Cl	1	0	CH_3	H	a
50	7-Cl	1	0	CH_3	H	$(CH_3)_2C{=}N{-}O$
51	7-Cl	1	0	CH_3	H	b
52	7-Cl	1	0	CH_3	H	c
53	7-Cl	1	0	CH_3	H	d
58	7-Cl	1	0	C_2H_5	H	C_2H_5O
59	7-Cl	0	1	CH_3	H	CH_3O

TABLE 1 (Continued)

Compound No	Substituents					
	A	k	l	R^1	U	G
60	7-Cl	1	0	CH_3	H	n-C_4H_9S
61	7-Cl	1	0	H	Cl	C_2H_5O
62	7-C_2H_5	1	0	CH_3	H	C_2H_5O
63	7-C_2H_5	0	0	CH_3	H	C_2H_5O
64	7-Cl	0	1	H	H	C_2H_5O
65	7-Cl	0	0	H	H	C_2H_5O
66	7-Cl	0	1	CH_3	H	C_2H_5O
67	7-CH_3	0	0	H	H	C_2H_5O
68	7-CH_3	0	0	C_2H_5	H	C_2H_5O
69	7-Cl	0	1	CH_3	H	OH
70	7-Cl	0	1	CH_3	H	n-C_4H_9S
71	7-Cl	0	0	CH_3	H	n-C_4H_9S
72	7-Cl	1	0	CH_3	H	Cl_2CHCH_2O
73	7-Cl	1	0	n-C_3H_7	H	C_2H_5O
85	7-Cl	1	0	H	H	C_2H_5O

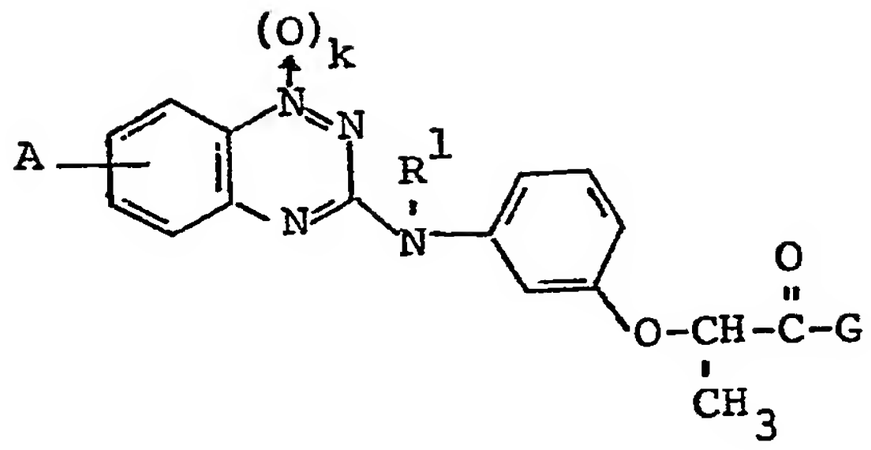
Footnote: a $CH\equiv C-\overset{CH_3}{\overset{|}{C}}-O-$ (with C_2H_5)

b $(CH_3)_2NCH_2CH_2O-$

c $HOCH_2C(CH_3)_2NH-$

d $ClCH_2C(CH_3)_2NH-$

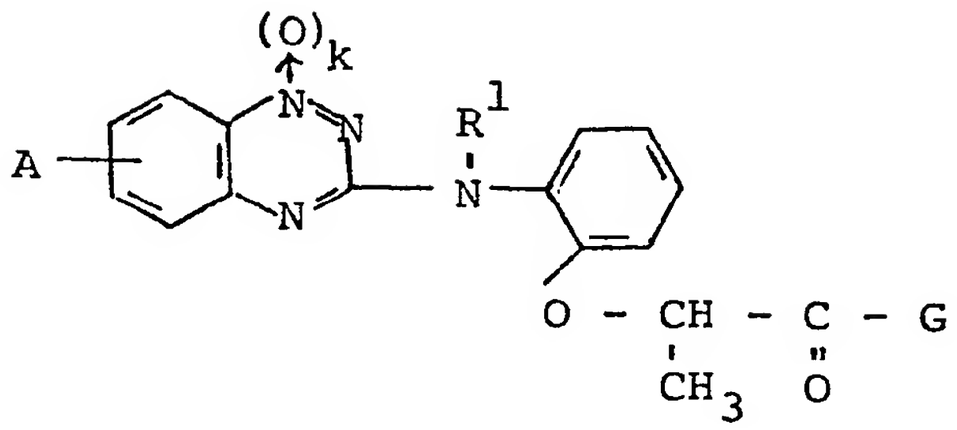
TABLE 2



IIIb

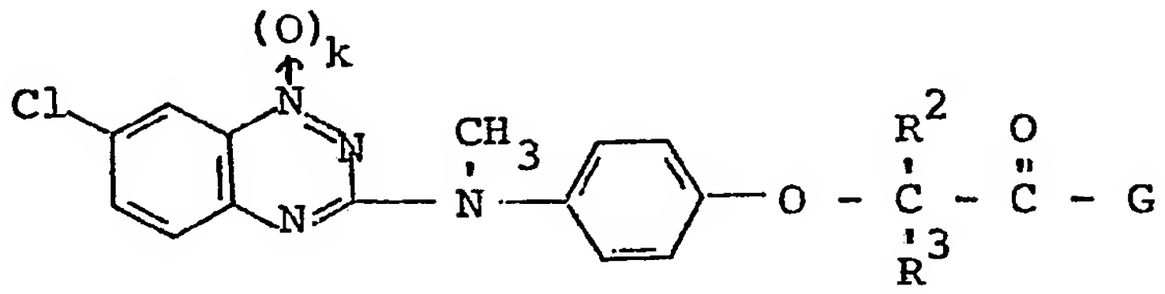
Compound No	Substituents			
	A	k	R^1	G
54	7-Cl	1	H	C_2H_5O
55	7-Cl	1	CH_3	C_2H_5O
56	7-Cl	0	H	C_2H_5O
57	7-Cl	0	CH_3	C_2H_5O

TABLE 3



Compound No	Substituents			
	A	k	R^1	G
74	7-Cl	1	H	C_2H_5O
75	7-Cl	1	CH_3	C_2H_5O

TABLE 4



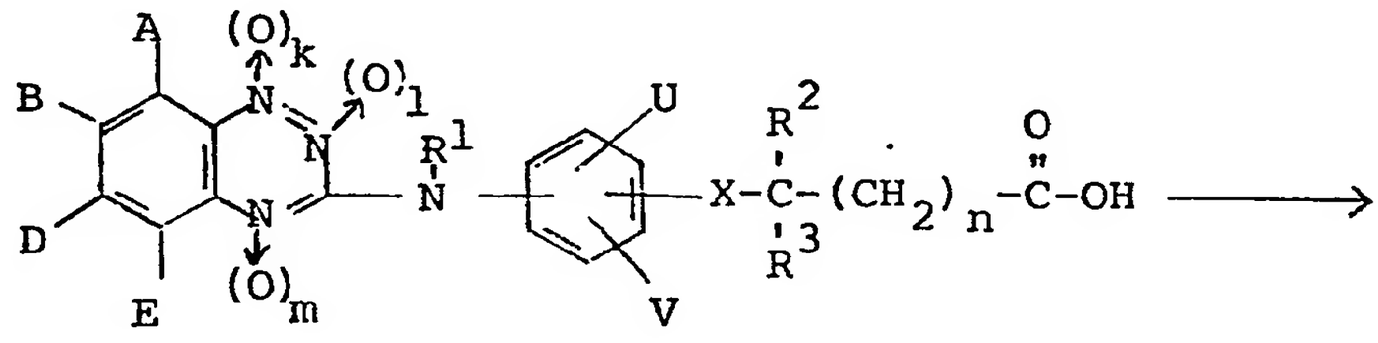
Compound No	Substituents			
	k	R^2	R^3	G
76	1	H	H	C_2H_5O
77	1	C_2H_5	H	C_2H_5O
78	1	H	H	$n\text{-}C_4H_9O$
79	1	CH_3OCH_2	H	CH_3O
80	0	C_2H_5	H	C_2H_5O
81	0	CH_3	CH_3	C_2H_5O
82	1	CH_3	CH_3	HO
83	1	CH_3	CH_3	$n\text{-}C_4H_9S$
84	1	CH_3	CH_3	C_2H_5O

The compounds of the invention may be prepared by a variety of methods and in a further aspect the invention provides methods for the preparation of the compounds of formula I.

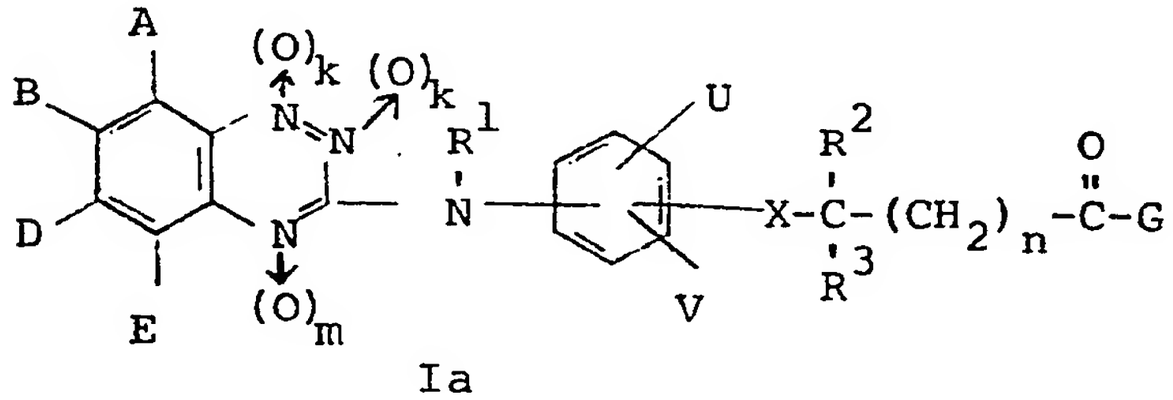
Compounds of formula Ia (I; W=C(=O)-G) wherein G is not hydroxy may be prepared from the acid of formula Ib (I; W=$-CO_2H$) by, for example, neutralisation of the acid with a base to give an acid salt, esterification of the acid with an alcohol, thiol, phenol or thiophenol to give an acid ester, or reaction of the acid

(or acid halide derivative thereof) with an amine to give an amide (SCHEME A). Processes known in the art for the preparation of acid salts, acid esters, acid halides and acid amides may be adapted, without undue experimentation, to prepare compounds of the invention of formula Ia from compounds of the invention of formula Ib.

SCHEME A



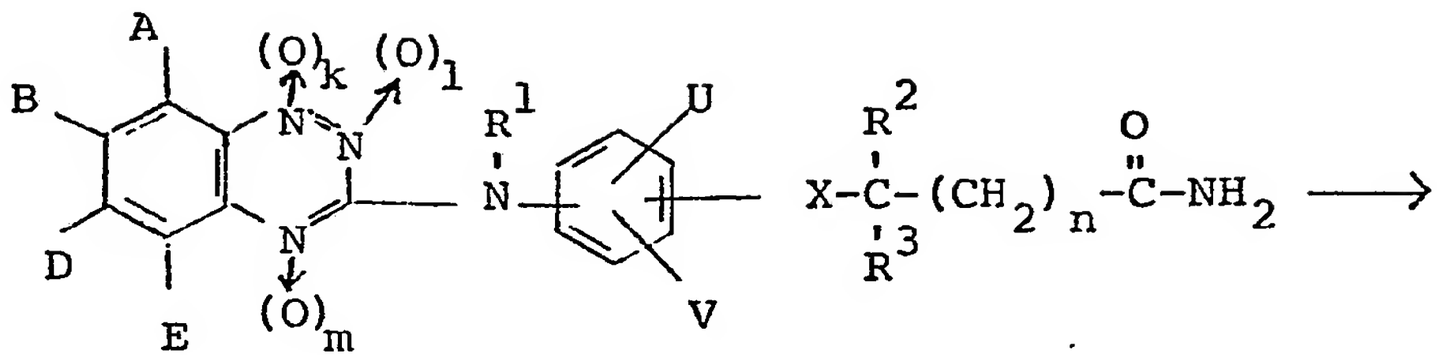
Ib



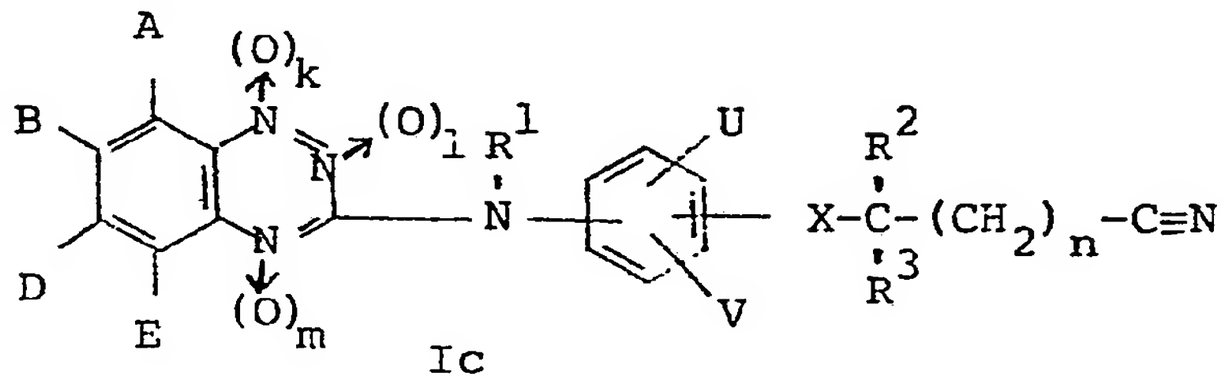
Ia

Nitriles of the invention of formula Ic (I; W=-C≡N) may be prepared, for example, from the acid amide of formula Id (I; W=-$CONH_2$) (SCHEME B).

SCHEME B



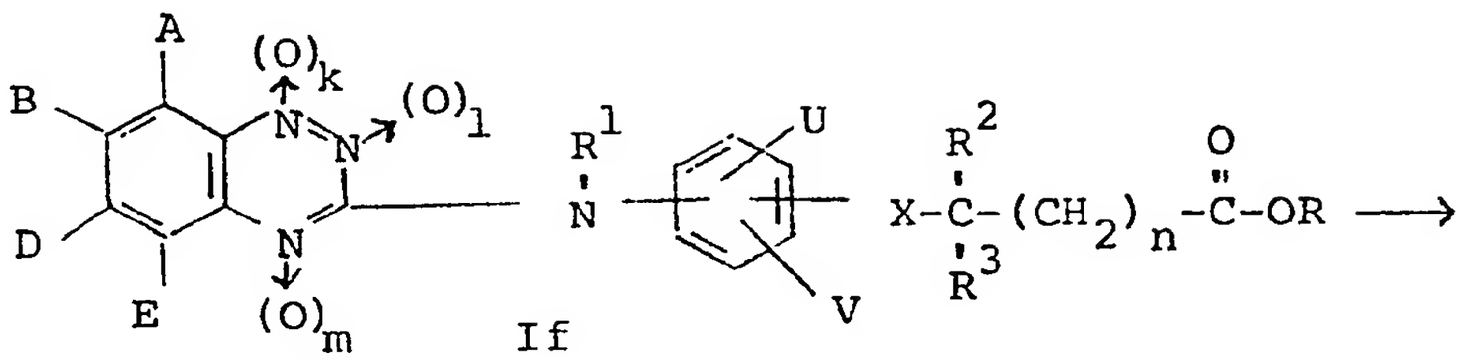
Id



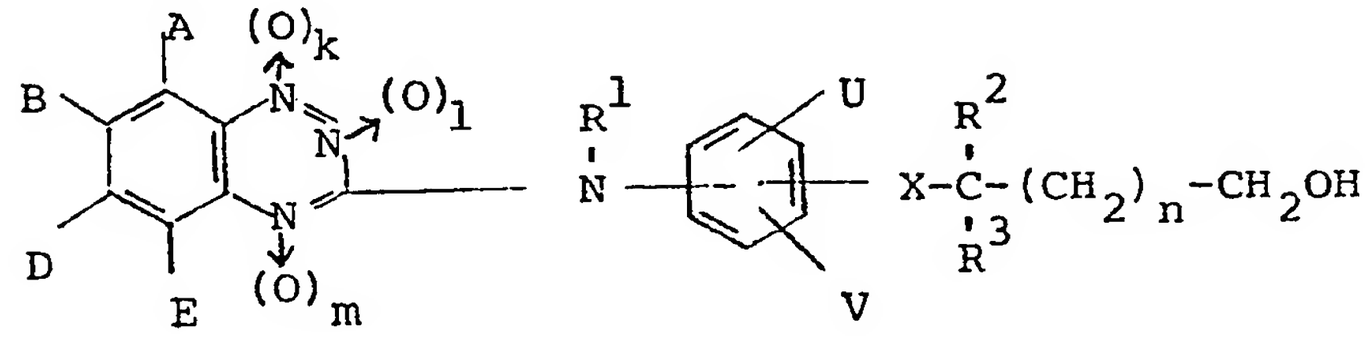
Ic

Alcohols of the invention of formula Ie (I; $W=CH_2OH$) may be prepared from the acid or acid esters of formula If (I; $W=-\overset{O}{\overset{\|}{C}}-G$ wherein G = OH or O-alkyl) by reduction (SCHEME C). Processes known in the art for the reduction of acids or acid esters to alcohols, for example lithium aluminium hydride reduction, may be adapted, without undue experimentation, to prepare alcohols of the invention of formula Ie from esters of the invention of formula If.

SCHEME C



If



Ie

Alkyl halides of the invention of formula Ig (I; W=-CH_2-halogen) may be prepared from alcohols of formula Ie (I; W=-CH_2OH) by halogenation. Processes known in the art for the conversion of alcohols to alkyl halides, for example halogenation with reagents such as thionyl chloride, may be adapted, without undue experimentation, to prepare alkyl halides of the invention of formula Ig from alcohols of the invention of formula Ie.

Ethers of the invention of formula Ih (I; W=CH_2OR) may be prepared from alcohols of formula Ie (I; W=-CH_2OH) by alkylation. Processes known in the art for the conversion of alcohols to ethers, for example by reaction with alkyl halides using the Williamson ether synthesis, may be adapted, without undue experimentation, to prepare ethers of the invention of formula Ih from

alcohols of the invention of formula Ie.

Ethers (thioethers) of the invention of formula Ih (Ii) [Ī; W=-CH_2OR(-CH_2SR)] may be prepared from alkyl halides of formula Ig (I; W=CH_2-halogen) by alkoxylation (thioalkylation). Processes known in the art for the conversion of alkyl halides to ethers (thioethers), for example by reaction with alcohols (thiols) using the Williamson ether synthesis, may be adapted, without undue experimentation, to prepare ethers (thioethers) of the invention of formula Ih (Ii) from alkyl halides of the invention of formula Ig.

Amines of the invention of formula Ij (I; W=$CH_2NR^4R^5$) may be prepared from the alkyl halides of formula Ig (I; W=-CH_2-halogen) by amination or from the amides of formula Ik (I; W=-$\overset{O}{\overset{\|}{C}}$-$NR^4R^5$) by reduction. Processes known in the art for the conversion of alkyl halides to amines, for example by reaction with amines, and for the conversion of amides to amines, for example by reduction with agents such as lithium aluminium hydride, may be adapted without undue experimentation, to prepare amines of the invention of formula Ij from alkyl halides of the invention of formula Ig and from amides of the invention of formula Ik respectively.

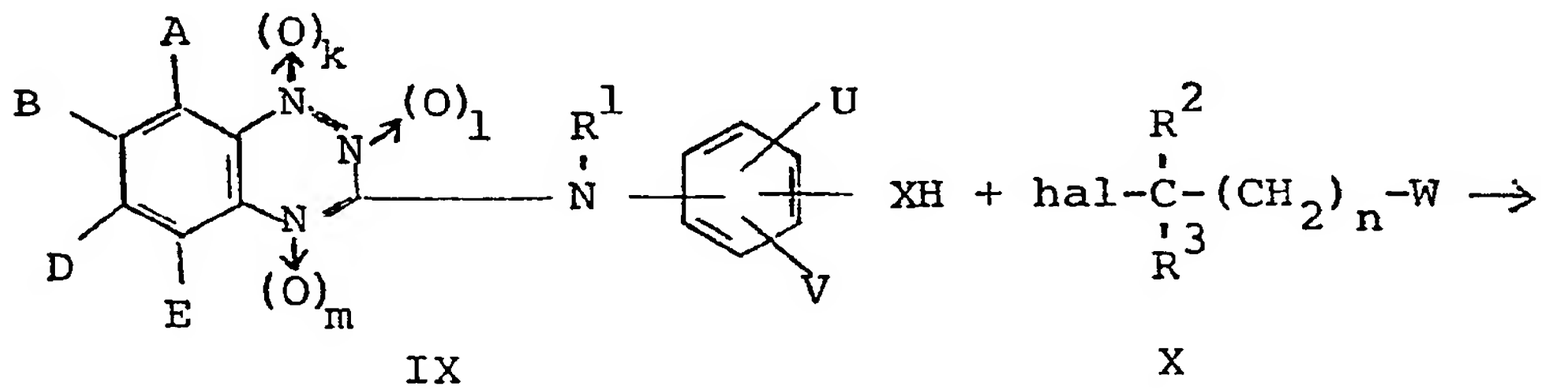
N-oxides of the invention of formula I wherein one or more of k, l and m is 1 may be prepared from compounds of formula I wherein k and/or l, and/or m is 0 by oxidation. Processes known in the art for the conversion of benzotriazines to benzotriazine N-oxides, for example oxidations using persulfates, peroxides, peracids or peresters, may be adapted without undue experimentation, to prepare the novel N-oxides of the invention.

Compounds of the invention of formula I wherein R^1 is not hydrogen may be prepared from compounds of the invention of formula I wherein R^1 is hydrogen by,

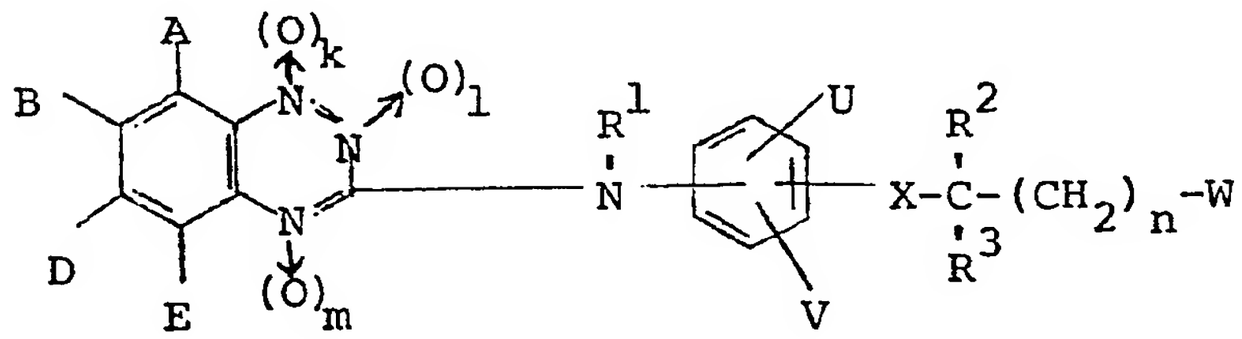
for example, alkylation or acylation. Processes known in the art for the preparation of derivatives of secondary amines, for example alkylations with alkyl halides and acylations with acyl halides, may be adapted, without undue experimentation, to prepare the novel compounds of the invention wherein R^1 is not hydrogen.

Compounds of formula I wherein A, B, D, E, U, V, X, R^1, R^2, R^3, W, k, l, m and n are as hereinbefore defined may be prepared by the condensation of a phenol or thiophenol of formula IX with a compound of formula X wherein hal is chlorine, bromine or iodine, preferably in the presence of an alkaline material; according to SCHEME D.

SCHEME D



IX X

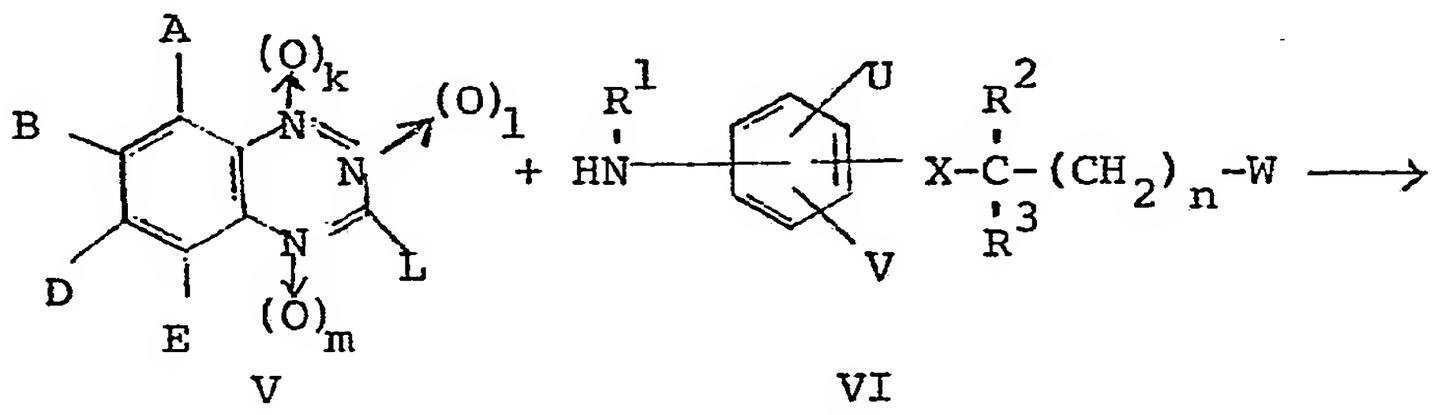


I

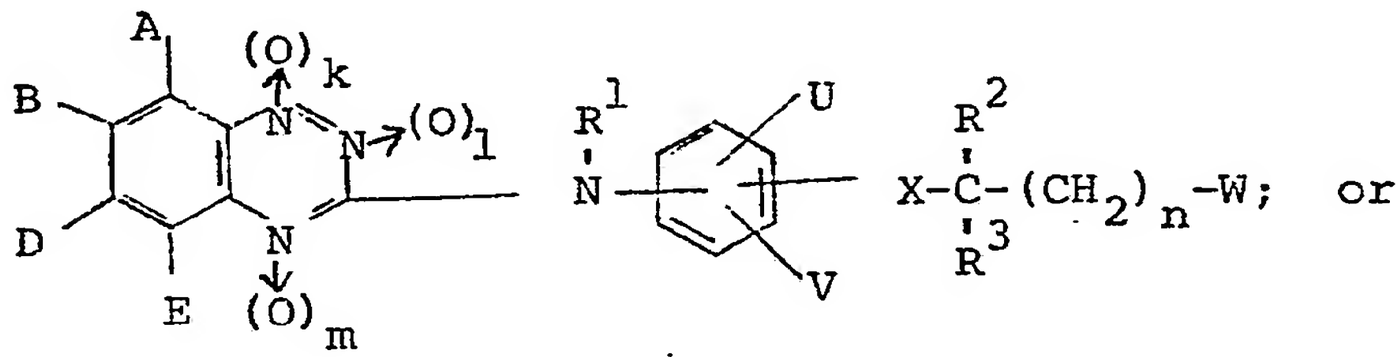
Compounds of formula I may also be prepared by:

a) the condensation of the appropriate benzotriazine derivative of formula V, wherein L is a leaving group (for example, alkylsulfonyl, chlorine, bromine or iodine) with the appropriate aniline of formula VI according to SCHEME E.

SCHEME E



V VI



I

b) the following steps in sequence:

(i) the condensation of the appropriate benzotriazine derivative of formula V, wherein L is a leaving group (for example, alkylsulfonyl, chlorine, bromine or iodine) with the appropriate aniline of formula VII, wherein Q is hydroxy, mercapto, C_1 to C_6

alkoxy of C_1 to C_6 alkylthio to give a compound of formula VIII wherein Q is hydroxy, mercapto, C_1 to C_6 alkoxy or C_1 to C_6 alkylthio;

(ii) the dealkylation of the compound of formula VIII prepared in step (i) above wherein Q is C_1 to C_6 alkoxy or C_1 to C_6 alkylthio to give a compound of formula IX; and

(iii) the condensation of the product of formula IX obtained in step (i) or step (ii) above with a compound of formula X according to the process described for SCHEME D above (Steps (i) and (ii) are shown in SCHEME F); or

c) the following steps in sequence:

(i) the condensation of the appropriate benzotriazine derivative of formula XI with the appropriate benzene derivative of formula XII wherein L is a leaving group (for example, alkylsulfonyl, chlorine, bromine or iodine) and Q is hydroxy, mercapto, C_1 to C_6 alkoxy or C_1 to C_6 alkylthio, to give a compound of formula VIII wherein Q is as hereinbefore defined;

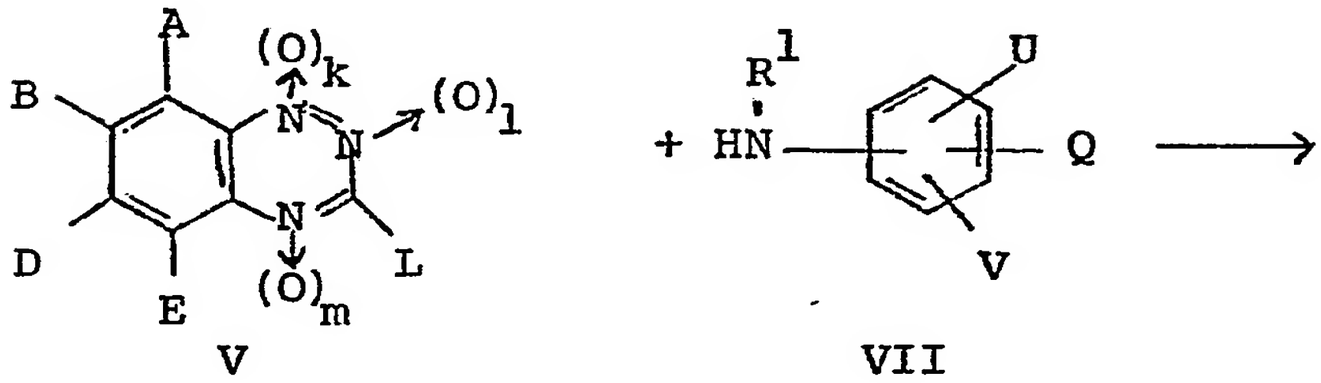
(ii) the dealkylation of the compound of formula VIII prepared in step (i) above wherein Q is C_1 to C_6 alkoxy or C_1 to C_6 alkylthio, to give a compound of formula IX according to the process described for SCHEME F step (ii) above; and

(iii) the condensation of the product of formula IX obtained in step (i) or step (ii) above with a compound of formula X according to the

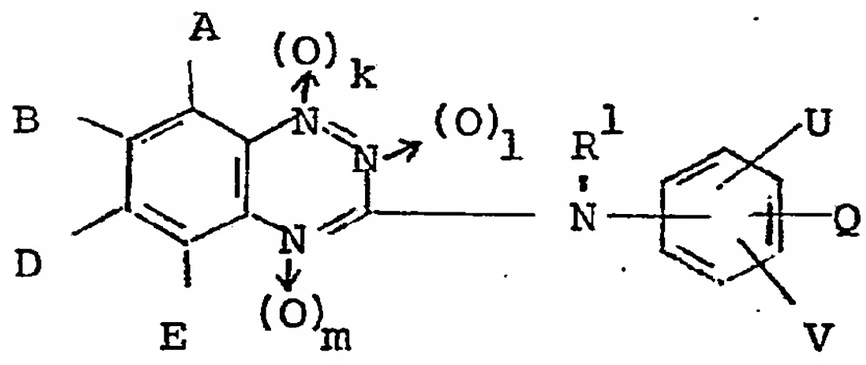
process described for SCHEME D above (step (i) is shown in SCHEME G).

SCHEME F

(i)

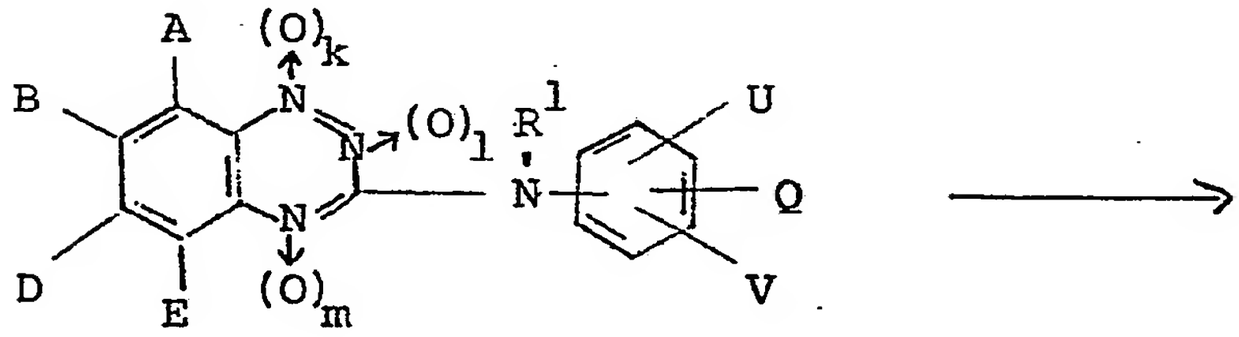


V VII

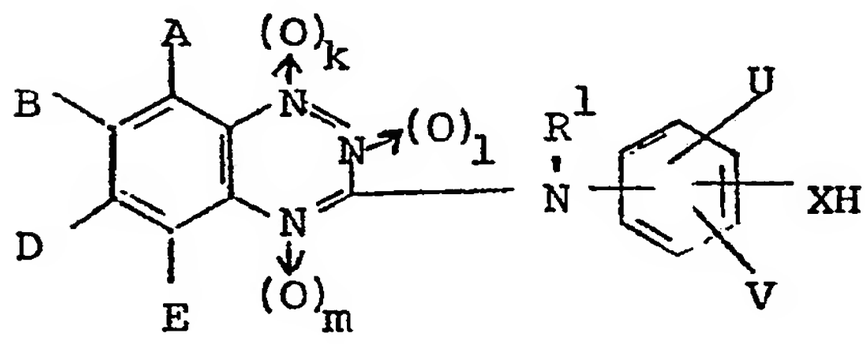


VIII

(ii)



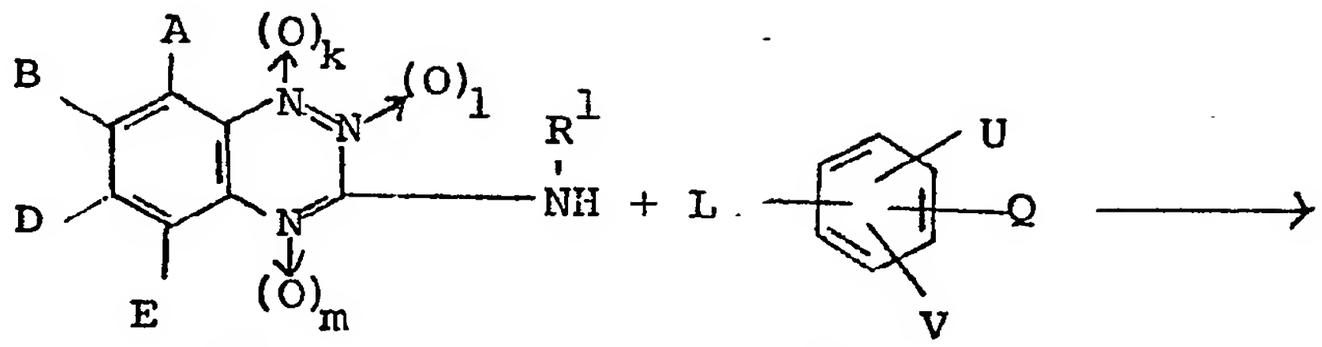
VIII



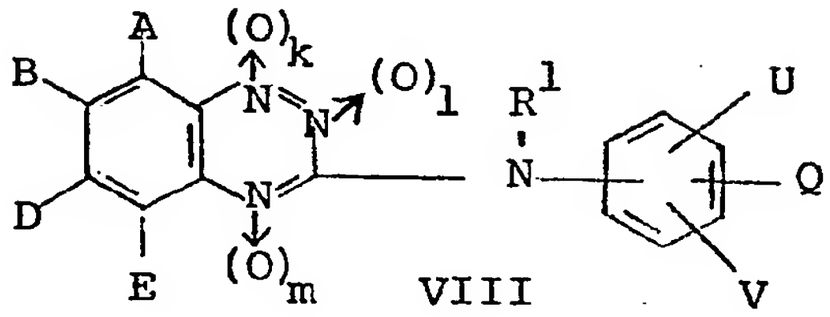
IX

SCHEME G

(i)



XI XII



VIII

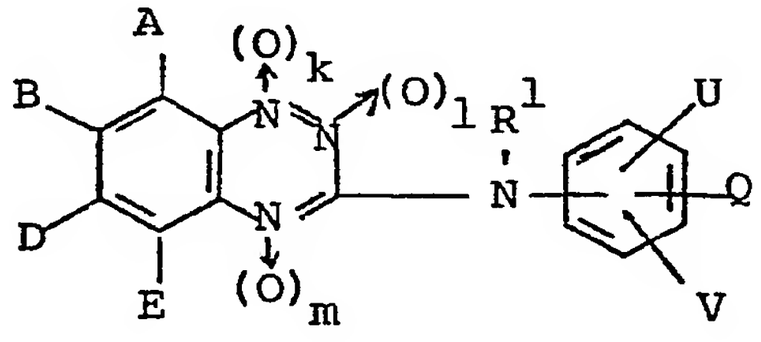
The condensation reaction illustrated in SCHEME D and outlined above is preferably carried out in the presence of an alkaline material and preferably in the presence of a solvent. Suitable alkaline materials include alkali metal and alkaline earth metal hydroxides and carbonates such as soduim hydroxide, potassium hydroxide, sodium carbonate and potassium carbonate. Suitable solvents include ketones such as, for example, acetone, methyl ethyl ketone and methyl isobutyl ketone, and dipolar aprotic solvents such as, for example, dimethylformamide, dimethylacetamide, dimethylsulfoxide, N-methylpyrrolidone, hexamethylphosphoramide and sulfolan.

The condensation reactions illustrated in SCHEMES E and F and outlined above are preferably carried out in the presence of a solvent.

The reaction conditions required to effect the condensation reactions illustrated in SCHEMES D, E, F and G and outlined above vary according to the nature of the reactants and the solvent used. In general the reaction is facilitated by the application of heat and usually a reaction temperature in the range of 40° to 150°C and reaction time of between 0.5 and 20 hours is satisfactory. However, higher or lower reaction temperatures and/or shorter or longer reaction times may be used if desired.

The dealkylation reactions illustrated in SCHEMES F and G and outlined in paragraph b)(ii) and c)(ii) above may be effected using a variety of reagents known in the art. For example, aryl-alkyl ethers may be cleaved using reagents such as pyridine hydrochloride, hydriodic acid, hydrobromic acid, sodium thioethoxide in dimethylformamide, acetyl p-toluenesulfonate, sodium or potassium iodide in formic or acetic acid, lithium iodide in 2,4,6-collidine and boron tribromide. Reaction times and reaction conditions vary widely depending on the dealkylation agent used and the ether to be cleaved. The reaction conditions generally employed when using the above "ether-cleavage" reagents are known to those skilled in the art and may be adapted without undue experimentation to effect the "ether-cleavage" reactions illustrated in SCHEMES F and G and outlined in paragraph b)(ii) and c)(ii) above.

The compounds of formula VIII



VIII,

which are useful intermediates in the preparation of compounds of formula I, are novel compounds. Therefore, in a further embodiment the invention provides compounds of formula VIII wherein A, B, D, E, k, l, m, R^1, U, V and Q are as hereinbefore defined.

The compounds of formula I are active as herbicides and therefore, in a further aspect the invention provides a process for severely damaging or killing unwanted plants which process comprises applying to the plants, or to the growth medium of the plants, an effective amount of a compound of formula I as hereinbefore defined.

Generally speaking the compounds of formula I are herbicidally effective against a variety of plants. However, certain of the compounds of the invention are selectively active against monocotyledonous plants, dicotyledonous plants being relatively unaffected by rates of application of the compounds of the invention which are severely damaging or lethal to other plant species.

Moreover, certain of the compounds of formula I are selectively active within the group of monocotyledonous plants and may be used at a rate sufficient to kill or severely damage monocotyledonous weeds in a monocotyledonous cereal crop.

Therefore, in yet a further aspect the invention provides a process for selectively controlling the growth of weeds in crops which process comprises applying to the crop, or to the growth medium of the crop, a compound of formula I, as hereinbefore defined, in an amount sufficient to severely damage or kill the weeds but insufficient to damage the crop substantially.

The compounds of formula I may be applied directly to the plant (post-emergence application) or to the soil before the emergence of the plant (pre-

emergence application). However, the compounds are, in general, more effective when applied to the plant post-emergence.

The compounds of formula I may be used on their own to inhibit the growth of, severely damage, or kill plants but are preferably used in the form of a composition comprising a compound of the invention in admixture with a carrier comprising a solid or liquid diluent. Therefore, in yet a further aspect the invention provides plant growth inhibiting, plant damaging, or plant killing compositions comprising a compound of formula I as hereinbefore defined and an inert carrier therefor.

Compositions according to the invention include both dilute compositions, which are ready for immediate use, and concentrated compositions, which require to be diluted before use, usually with water. Preferably the compositions contain from 0.01% to 90% by weight of the active ingredient. Dilute compositions ready for use preferably contain from 0.01% to 2% of active ingredient, while concentrated compositions may contain from 20 to 90% of active ingredient, although from 20 to 70% is usually preferred.

The solid compositions may be in the form of granules, or dusting powders wherein the active ingredient is mixed with a finely divided solid diluent, eg kaolin, bentonite, kieselguhr, dolomite, calcium carbonate, talc, powdered magnesia, Fuller's earth and gypsum. They may also be in the form of dispersible powders or grains, comprising a wetting agent to facilitate the dispersion of the powder or grains in liquid. Solid compositions in the form of a powder may be applied as foliar dusts.

Liquid compositions may comprise a solution or dispersion of an active ingredient in water optionally

containing a surface-active agent, or may comprise a solution or dispersion of an active ingredient in a water-immiscible organic solvent which is dispersed as droplets in water.

Surface-active agents may be of the cationic, anionic, or non-ionic type. The cationic agents are, for example, quaternary ammonium compounds (eg cetyltrimethylammonium bromide). Suitable anionic agents are soaps; salts of aliphatic mono esters of sulphuric acid, for example sodium lauryl sulphate; and salts of sulphonated aromatic compounds, for example sodium dodecylbenzenesulphonate, sodium, calcium, and ammonium lignosulphonate, butylnaphthalene sulphonate, and a mixture of the sodium salts of diisopropyl- and triisopropylnaphthalenesulphonic acid. Suitable non-ionic agents are the condensation products of ethylene oxide with fatty alcohols such as oleyl alcohol and cetyl alcohol, or with alkylphenols such as octyl- or nonyl-phenol or octyl-cresol. Other non-ionic agents are the partial esters derived from long chain fatty acids and hexitol anhydrides, for example sorbitan monolaurate; the condensation products of the partial esters with ehtylene oxide; and the lecithins.

The aqueous solutions or dispersions may be prepared by dissolving the active ingredient in water or an organic solvent optionally containing wetting or dispersing agent(s) and then, when organic solvents are used, adding the mixture so obtained to water optionally containing wetting or dispersing agent(s). Suitable organic solvents include, for example, ethylene dichloride, isopropyl alcohol, propylene glycol, diacetone alcohol, toluene, kerosene, methylnaphthalene, the xylenes and trichloroethylene.

The compositions for use in the form of aqueous solutions or dispersions are generally supplied in the

form of a concentrate containing a high proportion of the active ingredient, and the concentrate is then diluted with water before use. The concentrates are usually required to withstand storage for prolonged periods and after such storage, to be capable of dilution with water to form aqueous preparations which remain homogeneous for a sufficient time to enable them to be applied by conventional spray equipment. Concentrates conveniently contain 20-90%, preferably 20-70%, by weight of the active ingredient(s). Dilute preparations ready for use may contain varying amounts of the active ingredient(s) depending upon the intended purpose; amounts of 0.01% to 10.0% and preferably 0.1% to 2%, by weight of active ingredient(s) are normally used.

A preferred form of concentrated composition comprises the active ingredient which has been finely divided and which has been dispersed in water in the presence of a surface-active agent and a suspending agent. Suitable suspending agents are hydrophilic colloids and include, for example, polyvinylpyrrolidone and sodium carboxymethylcellulose, and the vegetable gums, for example gum acacia and gum tragacanth. Preferred suspending agents are those which impart thixotropic properties to, and increase the viscosity of the concentrate. Examples of preferred suspending agents include hydrated colloidal mineral silicates, such as montmorillonite, beidellite, nontronite, hectorite, saponite, and saucorite. Bentonite is especially preferred. Other suspending agents include cellulose derivatives and polyvinyl alcohol.

The rate of application of the compounds of the invention will depend on a number of factors including, for example, the compound chosen for use, the identity of the plants whose growth is to be inhibited the

formulations selected for use and whether the compound is to be applied for foliage or root uptake. As a general guide, however, an application rate of from 0.005 to 20 kilograms per hectare is suitable while from 0.01 to 5 kilograms per hectare may be preferred.

The compositions of the invention may comprise, in addition to one or more compounds of the invention, one or more compounds not of the invention but which possess biological activity. For example, as hereinbefore indicated the compounds of the invention are in general substantially more effective against monocotyledonous plants or grass species than against dicotyledonous plants or broad-leaved species. As a result, in certain applications the herbicidal use of the compounds of the invention alone may be sufficient to protect a crop. Accordingly in yet a still further embodiment the invention provides a herbicidal composition comprising a mixutre of at least one herbicidal compound of formula I as hereinbefore defined with at least one other herbicide.

The other herbicide may be any herbicide not having the formula I. It will generally be a herbicide having a complementary action. For example, one preferred class is of mixtures comprising a herbicide active against broad-leaved weeds. A second preferred class is of mixtures comprising a contact herbicide.

Examples of useful complementary herbicides include:

A. benzo-2,1,3-thiadiazin-4-one-2,2-dioxides such as 3-isopropylbenzo-2,1,3-thiadiazin-4-one-2,2-dioxide (common name bentazon);

B. hormone herbicides and in particular the phenoxyalkanoic acids such as 4-chloro-2-methylphenoxy acetic acid (common name MCPA), 2-(2,4-dichlorophenoxy)propionic acid (common name dichlorprop),

2,4,5-trichlorophenoxyacetic acid (common name 2,4,5-T), 4-(4-chloro-2-methylphenoxy)butyric acid (common name MCPB), 2,4-dichlorophenoxyacetic acid (common name 2,4-D), 4-(2,4-dichlorophenoxy)butyric acid (common name 2,4-DB), 2-(4-chloro-2-methylphenoxy)propionic acid (common name mecoprop), and their derivatives (eg salts, esters, amides and the like);

C. 3-[4-(4-halophenoxy)phenyl]-1,1-dialkylureas such as 3-[4-(4-chlorophenoxy)phenyl]-1,1-dimethylurea (common name chloroxuron);

D. dinitrophenols and their derivatives (eg acetates) such as 2-methyl-4,6-dinitrophenol (common name DNOC), 2-tertiarybutyl-4,6-dinitrophenol (common name dinoterb), 2-secondarybutyl-4,6-dinitrophenol (common name dinoseb) and its ester dinoseb acetate;

E. dinitroaniline herbicides such as N',N'-diethyl-2,6-dinitro-4-trifluoromethyl-m-phenylenediamine (common name dinitramine), 2,6-dinitro-N,N-dipropyl-4-trifluoromethylaniline (common name trifluralin) and 4-methylsulfonyl-2,6-dinitro-N,N-dipropylaniline (common name nitralin);

F. phenylurea herbicdes such as N'-(3,4-dichlorophenyl)-N,N-dimethylurea (common name diuron) and N,N-dimethyl-N'-[3-(trifluoromethyl)phenyl]urea (common name fluometuron);

G. phenylcarbamoyloxyphenylcarbamates such as 3-[(methoxycarbonyl)amino]phenyl (3-methylphenyl)-carbamate (common name phenmedipham) and 3-[(ethoxycarbonyl)amino]phenyl phenylcarbamate (common name desmedipham);

H. 2-phenylpyridazin-3-ones such as 5-amino-4-chloro-2-

phenylpyridazin-3-one (common name pyrazon);

I. uracil herbicides such as 3-cyclohexyl-5,6-trimethyleneuracil (common name lenacil), 5-bromo-3-sec-butyl-6-methyluracil (common name bromacil) and 3-tert-butyl-5-chloro-6-methyluracil (common name terbacil);

J. triazine herbicides such as 2-chloro-4-ethylamino-6-(iso-propylamino)-1,3,5-triazine (common name atrazine), 2-chloro-4,6-di(ethylamino)-1,3,5-triazine (common name simazine) and 2-azido-4-(iso-propylamino)-6-methylthio-1,3,5-triazine (common name aziprotryne);

K. 1-alkoxy-1-alkyl-3-phenylurea herbicides such as 3-(3,4-dichlorophenyl)-1-methoxy-1-methylurea (common name linuron), 3-(4-chlorophenyl)-1-methoxy-1-methylurea (common name monolinuron) and 3-(4-bromo-4-chlorophenyl)-1-methoxy-1-methylurea (common name chlorobromuron);

L. thiolcarbamate herbicides such as S-propyl dipropyl-thiocarbamate (common name verolate);

M. 1,2,4-triazin-5-one herbicides such as 4-amino-4,5-dihydro-3-methyl-6-phenyl-1,2,4-triazine-5-one (common name metamitron) and 4-amino-6-tert-butyl-4,5-dihydro-3-methylthio-1,3,4-triazin-5-one (common name metribuzin);

N. benzoic acid herbicides such as 2,3,6-trichloro-benzoic acid (common name 2,3,6-TBA), 3,6-dichloro-2-methoxybenzoic acid (common name dicamba) and 3-amino-2,5-dichlorobenzoic acid (common name chloramben).

O. anilide herbicides such as N-butoxymethyl-α-chloro-2',6'-diethylacetanilide (common name butachlor), the corresponding N-methoxy compound (common name

alachlor), the corresponding N-iso-propyl compound (common name propachlor) and 3',4'-dichloro-propionanilide (common name propanil);

P. dihalobenzonitrile herbicides such as 2,6-dichloro-benzonitrile (common name dichlobenil), 3,5-dibromo-4-hydroxybenzontrile (common name bromoxynil) and 3,5-diiodo-4-hydroxybenzonitrile (common name ioxynil).

Q. haloalkanoic herbicides such as 2,2-dichloro-propionic acid (common name dalapon), trichloro-acetic acid (common name TCA) and salts thereof;

R. diphenylether herbicides such as 4-nitrophenyl 2-nitro-4-trifluoromethylphenyl ether (common name fluorodifen), methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate (common name bifenox), 2-nitro-5-(2-chloro-4-trifluoromethylphenoxy)benzoic acid, 2-chloro-4-trifluoromethylphenyl 3-ethoxy-4-nitro-phenyl ether and the compounds disclosed in European Patent publication No 3,416; and

S. miscellaneous herbicides including N,N-dimethyl-diphenylacetamide (common name diphenamid), N-(1-naphthyl)phthalamic acid (common name naptalam) and 3-amino-1,2,4-triazole.

Examples of useful contact herbicides include:

T. bipyridylium herbicides such as those in which the active entity is the 1,1'-dimethyl-4,4'-dipyridylium ion (common name paraquat) and those in which the active entity is the 1,1'-ethylene-2,2'-dipyridylium ion (common name diquat);

U. organoarsenical herbicides such as monosodium methanearsonate (common name MSMA); and

V. amino acid herbicides such as N-(phosphonomethyl)-glycine (common name glyphosate) and its salts and esters.

The invention is now illustrated by, but in no way limited to, the following Examples.

Example 1

Methyl 2-{4-/N-methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (1)

a) A mixture of 3,7-dichloro-1,2,4-benzotriazine 1-oxide* (3.5 g), 4-(N-methylamino)phenol sulfate (5.6 g) and aqeuous ethanol (50 ml) was heated under reflux for a period of 18 hours. The solvent was partially removed by evaporation and the red solid precipitated (3.0 g) was collected by filtration. Chromatography over silica gel (80 g) with chloroform elution gave 4-/methyl(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenol (2.1 g) as a red solid.

Mass spectrometry: Found $M^{\oplus}$ (molecular ion) at m/e 302; $C_{14}H_{11}ClN_4O_2$ required 302.

b) A mixture of 4-/methyl(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenol (2.1 g), methyl 2-bromopropionate (1.9 g), anhydrous potassium carbonate (1.6 g) and methyl ethyl ketone (30 ml) was heated under reflux for a period of 20 hours. The reaction mixture was filtered and the solvent removed by distillation under reduced pressure to give an orange solid (3.0 g). Chromatography over silica gel (70 g) using chloroform/methanol as eluent gave methyl 2-{4-/methyl(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (2.7 g) as an orange solid.

Mass spectrometry: Found $M^{\oplus}$ (molecular ion) at m/e 386; $C_{18}H_{17}ClN_4O_4$ requires 386.

*Prepared according to the process of J Jui and G. P. Mueller, J. Org. Chem., 24, 813-818 (1959).
See also F. J. Wolf, R. M. Wilson, K. P. Fister and

M. Tishler, J. Amer. Chem. Soc., 76, 4611-4613 (1954).

Example 2

Methyl 2-{4-[N-methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino]phenoxy}propionate (1)

a) A mixture of 3,7-dichloro-1,2,4-benzotriazine-1-oxide (30.0 g), 4-(N-methylamino)phenol sulfate (48.0 g), water (400 ml) and acetonitrile (400 ml) was heated under reflux, with stirring, for a period of 24 hours. The solution was concentrated and on cooling red crystals formed. The product was recrystallised from acetonitrile-water to give 4-[N-methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino]phenol (36.5 g) as a red crystalline solid, mp 228-230°C.

b) A mixture of 4-[N-methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino]phenol (20.8 g), methyl 2-bromopropionate (13.8 g), anhydrous potassium carbonate (11.4 g) and anhydrous dimethylformamide (100 ml) was heated, with stirring, at a temperature of 100°C for a period of 2 hours. Dichloromethane was added to the cooled solution and the mixture was washed repeatedly with water. The organic phase was dried (over anhydrous magnesium sulfate) and the solvent was removed by distillation under reduced pressure. The product was recrystallised from methanol to give the title product (16.8 g) as orange crystals, mp 132°C.

The assigned structure was confirmed by proton magnetic resonance spectroscopy and mass spectrometry.

Example 3

Compounds no 13, 14, 15, 16, 17, 18, 19, 22 and 62 detailed in Table 1 were prepared from the appropriate 1,2,4-benzotriazine, 4-(N-methylamino)phenol sulfate and the appropriate alkyl 2-halopropionate following

essentially the same procedure as that described in Example 1 or Example 2.

The structure assigned to each compound was confirmed by proton magnetic resonance spectroscopy and mass spectrometry and appropriate physical data is recorded in Example 24, Table 5.

Example 4

Methyl 2-{4-/N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (2)

a) A mixture of 3,7-dichloro-1,2,4-benzotriazine-1-oxide* (3.5 g), 4-aminophenol (3.53 g) and aqueous ethanol (30 ml) was heated under reflux for a period of 18 hours. The solvent was removed by distillation under reduced pressure to give 4-/(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenol (4.0 g).

b) A mixture of 4-/(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenol (4.0 g; from part a) above), methyl 2-bromopropionate (3.7 g), anhydrous potassium carbonate (3.0 g) and methyl ethyl ketone (40 ml) was heated under reflux for a period of 18 hours. The solvent was removed by distillation under reduced pressure and the residue was partitioned between water and chloroform. The chloroform layer was dried and the chloroform evaporated to give a crimson solid (3.0 g). The solid was washed with boiling methanol to give methyl 2-{4-/(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (2.0 g) as a red solid.

Mass spectrometry: Found $M^{\oplus}$ (molecular ion) at m/e 374; $C_{17}H_{15}ClN_4O_4$ requires 374.

Example 5

Compounds no 12, 54, 56, 65, 67, 74 and 85 detailed in Tables 1, 2 and 3 were prepared from the appropriate 1,2,4-benzotriazine, 4-aminophenol and the

appropriate alkyl 2-halopropionate following essentially the same procedure as that described in Example 4.

The structure assigned to each compound was confirmed by proton magnetic resonance spectroscopy and mass spectrometry and appropriate physical data is recorded in Example 24, Table 5.

Example 6

Methyl 2-{4-/N-methyl-N-(7-chloro-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (3)

a) 4-/N-Methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenol (10.0 g; Example 1 part a)) and zinc powder (4.3 g) were added to a mixture of acetic acid (100 ml) and water (10 ml) and the mixture was heated at a temperature of 100°C, with vigorous stirring, for a period of 30 minutes. Further zinc powder (4.3 g) was added and the heating and stirring was continued for a further 30 minutes. The cooled mixture was filtered and the filtrate was added to a solution of hydrogen peroxide (5 ml of 30% v/v) in water (100 ml) and the aqueous mixture was stirred at room temperature for a period of 1 hour. The solid was collected by filtration, washed with water and dried to give 4-/N-methyl-N-(7-chloro-1,2,4-benzotriazin-3-yl-amino/phenol (8.2 g) as a red crystalline solid, mp 224-226°C.

b) 4-/N-Methyl-N-(7-chloro-1,2,4-benzotriazin-3-yl)-amino/phenol was reacted with methyl 2-bromopropionate following essentially the same procedure as that described in Example 1 part b) to give the title compound, mp 120°C.

The assigned structure was confirmed by proton magnetic resonance spectroscopy and mass spectrometry.

Example 7

Compounds no 20, 21, 23, 27, 29, 48 and 63 detailed in Table 1 were prepared by the reduction of the appropriate 4-[N-methyl-N-(1-oxide-1,2,4-benzotriazin-3-yl)amino]phenol and subsequent reaction of the appropriate 4-[N-methyl-N-(1,2,4-benzotriazin-3-yl)-amino]phenol with the appropriate alkyl 2-halopropionate following essentially the same procedure as that described in Example 6.

The structure assigned to each compound was confirmed by proton magnetic resonance spectroscopy and mass spectrometry and appropriate physical data is recorded in Example 24, Table 5.

Example 8

Ethyl 2-{4-[N-ethyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino]phenoxy}propionate (58)

A mixture of ethyl 2-{4-[N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino]phenoxy}propionate (1.5 g; compound no 85 see Example 5), sodium hydride (0.19 g of a 50% dispersion in mineral oil), ethyl iodide (0.60 g) and dimethylformamide was stirred at room temperature for a period of 15 minutes. The mixture was poured into dichloromethane and washed repeatedly with water. The organic phase was dried (over anhydrous magnesium sulfate) and the solvent was removed by distillation under reduced pressure to give a red oil. The crude product was purified by chromatography over silica gel (eluent dichloromethane) to give the title compound as a red oil.

The assigned structure was confirmed by proton magnetic resonance spectroscopy and mass spectrometry. Pmr spectrum (δ ppm in $CDCl_3$): 1.30, t, 3H; 1.65, d, 3H; 4.20, m, 4H; 4.80 q, 1H; 7.20, m, 4H; 7.60, d, 2H; 8.20, s, 1H.

Example 9

The compounds no 24, 25, 26, 30, 31, 32, 55, 57, 68, 73 and 75 detailed in Tables 1, 2 and 3 were prepared by the alkylation of the corresponding compound of formula I wherein R^1 is H with the appropriate alkyl halide following essentially the same procedure as that described in Example 8 (compound no 65 was used to prepare compounds no 24, 25, 26, 30, 31 and 32 and compounds no 54, 56, 67, 85 and 74 were used to prepare compounds no 55, 57, 68, 73 and 75 respectively).

The structure assigned to each compound was confirmed by proton magnetic resonance spectroscopy and mass spectrometry and appropriate physical data is recorded in Example 24, Table 5.

Example 10

2-{4-[N-methyl-N-(7-chloro-1,2,4-benzotriazin-3-yl)amino]phenoxy}propionic acid (28)

Ethyl 2- 4-[N-methyl-N-(7-chloro-1,2,4-benzotriazin-3-yl)amino]phenoxy propionate (5.0 g; compound no 21, Example 7) was suspended in isopropyl alcohol (25 ml) and a solution of sodium hydroxide (0.56 g) in water (25 ml) was added over a period of 45 minutes. Further isopropyl alcohol (30 ml) was added and the mixture was stirred at room temperature for a period of 48 hours. The alcohol was removed by distillation under reduced pressure, the residue was dissolved in water and the aqueous solution was acidified to pH4 by the addition of aqueous 2M hydrochloric acid. The precipitate was collected by filtration, and dried to give the title compound, mp 125°C.

The assigned structure was confirmed by proton magnetic resonance spectroscopy and mass spectrometry.

Example 11

Compounds no 44, 69 and 82 detailed in Tables 1

and 4 were prepared by the hydrolysis of the corresponding esters (18, 59 and 84 respectively) following essentially the same procedure as that described in Example 10.

The structure assigned to each compound was confirmed by proton magnetic resonance spectroscopy and mass spectrometry and appropriate physical data is recorded in Example 24, Table 5.

Example 12

n-Propyl 2-{4-/N-methyl-N-(7-chloro-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (36)

A mixture of ethyl 2-{4-/N-methyl-N-(7-chloro-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (80 g, compound no 21, Example 7), n-propanol (800 ml) and concentrated sulfuric acid (3 ml) was heated under reflux for a period of 6 hours. A small volume of water was added and the mixture was concentrated. Dichloromethane was added and the mixture was washed first with dilute aqueous potassium carbonate solution and then with water. The organic phase was dried (over anhydrous magnesium sulfate) and the solvent was removed by distillation under reduced pressure to give the title compound (80 g) as a red oil.

The assigned structure was confirmed by proton magnetic resonance spectroscopy and mass spectrometry. Pmr spectrum (ppm in $CDCl_3$): 0.90, t, 3H; 1.65, m, 5H; 3.65, s, 3H; 4.20, t, 2H; 4.80, q, 1H; 7.20, m, 4H; 7.65, s, 2H; 8.25, s, 1H.

Example 13

Compounds no 33, 34, 35, 40, 41, 42, 43 and 78 detailed in Tables 1 and 4 were prepared from the corresponding ethyl esters by transesterification (compounds no 33, 34 and 35 were prepared from compound no 21; compounds no 40, 41, 42 and 43 were prepared from

compound no 18; compound no 78 was prepared from compound no 76) following essentially the same procedure as that described in Example 12.

The structure assigned to each compound was confirmed by proton magnetic resonance spectroscopy and mass spectrometry and appropriate physical data is recorded in Example 24, Table 5.

Example 14

Sodium 2-{4-/N-methyl-N-(7-chloro-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (37), mp 178°C, and sodium 2-{4-/N-methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (45), mp 184°C, were prepared by the neutralization of their corresponding acids (compound 28, Example 10 and compound 44, Example 11, respectively) with aqueous sodium hydroxide and removal of the solvent under reduced pressure.

Example 15

2-(Dimethylamino)ethyl 2-{4-/N-methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (51)

a) A mixture of 2-{4-/N-methyl-N-(7-chloro-2-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionic acid (1.5 g; compound no 44, Example 11) and excess thionyl chloride was heated under reflux for a period of 5 hours. The excess thionyl chloride was removed by distillation under reduced pressure to give 2-{4-/N-methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy propionyl}chloride.

b) A mixture of the acid chloride prepared in a) above, 2-(dimethylamino)ethanol (0.41 g) and dichloromethane (20 ml) was stirred at room temperature overnight. The solvent was removed by distillation under reduced pressure to give a red oil. The crude product was purified by chromatography over silica gel (eluent

dichloromethane) to give the title compound (1.0 g) as a red oil.

The assigned structure was confirmed by proton magnetic resonance spectroscopy and mass spectrometry. Pmr spectrum (δppm in $CDCl_3$); 1.65, d, 3H; 2.00, s, 6H; 2.40, t, 2H; 3.65, s, 3H; 4.15, t, 2H; 4.80, q, 1H; 7.20, m, 4H; 7.60, s, 2H; 8.20, s, 1H.

Example 16

Compounds no 38, 39, 49, 50, 52, 53, 60, 70, 71, 72 and 83 detailed in Tables 1 and 4 were prepared from the corresponding acids via the acid chlorides following essentially the same procedure as that described in Example 15. Compounds no 38, 39 and 71 were prepared from the acid compound no 28, Example 10; compounds no 49, 50, 52, 53, 60 and 72 were prepared from the acid compound no 44, Example 11; compound no 70 was prepared from the acid compound no 69, Example 11; and compound no 83 was prepared from the acid compound no 82, Example 11.

The structure assigned to each compound was confirmed by proton magnetic resonance spectroscopy and mass spectrometry and appropriate physical data is recorded in Example 24, Table 5.

Example 17

Propargyl 2-{4-/N-methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (47)

A mixture of 2-{4-/N-methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionic acid (2.1 g; compound no 44, Example 11), p-toluenesulfonic acid (0.5 g) and excess propargyl alcohol were stirred at a temperature of 100°C for a period of 4 hours. The cooled solution was poured into ethyl acetate and the mixture was washed with water. The organic phase was dried (over anhydrous magnesium sulfate) and the solvent

was removed by distillation under reduced pressure to give an oil. The crude product was purified by chromatography over silica gel (eluent dichloromethane) to give the title compound (1.26 g) as an orange crystalline solid, mp 101°C.

The assigned structure was confirmed by proton magnetic resonance spectroscopy and mass spectrometry.

Example 18

Allyl 2-{4-/N-methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (46)

was prepared from 2-{4-/N-methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionic acid and allyl alcohol, and n-propyl 2-{4-/N-methyl-N-(7-chloro-2-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (66) was prepared from 2-{4-/N-methyl-N-(7-chloro-2-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionic acid and n-propanol, following essentially the same procedure as that described in Example 17.

The structure assigned to each compound was confirmed by proton magnetic resonance spectroscopy and mass spectrometry and appropriate physical data is recorded in Example 24, Table 5.

Example 19

Ethyl 2-{4-/N-methyl-N-(7-chloro-1,2,4-benzotriazin-3-yl)amino/phenoxy}-2-methylpropionate (81)

A mixture of 4-/N-methyl-N-(7-chloro-1,2,4-benzotriazin-3-yl)amino/phenol (1.5 g; Example 6 part a)), ethyl 2-bromo-2-methylpropionate (1.23 g), anhydrous potassium carbonate (0.87 g) and dimethylformamide (15 ml) was heated, with stirring, at a temperature of 100°C for a period of 3 days. The cooled solution was poured into dichloromethane and the mixture was washed with water. The aqueous phase was dried (over anhydrous magnesium sulfate) and the solvent was

removed by distillation under reduced pressure to give an oil. The crude product was purified by chromatography over silica gel (eluent dichloromethane) to give the title compound (0.9 g) as a red oil.

The assigned structure was confirmed by proton magnetic resonance spectroscopy and mass spectrometry. Pmr spectrum (δ ppm in $CDCl_3$): 1.30, t, 3H; 1.70, s, 6H; 3.65, s, 3H; 4.30, q, 2H; 7.20, m, 4H; 7.60, s, 2H; 8.20, s, 1H.

Example 20

Compounds no 76, 77, 79, 80 and 84 were prepared from the appropriate 4-/N-methyl-N-(1,2,4-benzotriazin-3-yl)amino/phenol and the appropriate alkyl 2-haloalkanecarboxylate following essentially the same procedure as that described in Example 19.

The structure assigned to each compound was confirmed by proton magnetic resonance spectroscopy and mass spectrometry and appropriate physical data is recorded in Example 24, Table 5.

Example 21

Methyl 2-{4-/N-methyl-N-(7-chloro-2-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (59)

A mixture of methyl 2{4-/N-methyl-N-(7-chloro-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (6.1 g; compound no 3, Example 6), acetic acid (110 ml) and hydrogen peroxide (44 ml of 30% v/v) was stirred at room temperature for a period of 5 days. The precipitated yellow solid was collected by filtration and recrystallised from acetic acid to give the title compound (5.0 g) as a yellow crystalline solid, mp 130°C.

The assigned structure was confirmed by proton magnetic resonance spectroscopy and mass spectrometry.

Example 22

Ethyl 2-{4-/N-(7-chloro-2-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (64)

was prepared by the oxidation of ethyl 2-{4-/N-(7-chloro-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (compound no 65, Example 5) following essentially the same procedure as that described in Example 21.

The assigned structure was confirmed by proton magnetic resonance spectroscopy and mass spectrometry and appropriate physical data is recorded in Example 24, Table 5.

Example 23

Ethyl 2-{3-chloro-4-/N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (61)

A mixture of ethyl 2-{4-/N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino/phenoxy}propionate (1.5 g; compound no 85, Example 5), N-chlorosuccinimide (0.57 g) and dichloromethane (20 ml) was stirred at room temperature for a period of 3 days. The mixture was washed with water, dried (over anhydrous magnesium sulfate) and the solvent was removed by distillation under reduced pressure to give a red oil. The crude product was purified by chromatography over silica gel (eluent dichloromethane) to give the title compound (0.81 g) as an orange crystalline solid, mp 169°C.

The assigned structure was confirmed by proton magnetic resonance spectroscopy and mass spectrometry.

Example 24

A number of the compounds of the invention detailed in Tables 1 to 4 are solids and can be identified by melting point. For convenience the melting points are tabulated in Table 5a below.

Many of the compounds of the invention detailed in Tables 1 to 4 are oils and were characterised by, and can be identified by, their proton magnetic resonance

(pmr) spectrum. For convenience the pmr spectroscopic data is recorded in Table 5b below.

TABLE 5a

Compound No	Melting Point °C	Compound No	Melting Point °C
1	132	45	184
2	194	46	94
3	120	47	101
12	193	52	77
13	140	53	62
14	130-132	54	142
15	132-134	56	108
16	130-132	59	130
17	<50	61	169
22	147	64	164-166
23	121	65	150-152
27	120	67	166-168
28	125	69	159-161
30	99	74	100
34	82	75	113
37	178	76	125
40	95	77	98
41	<50	79	66
42	70	82	199
43	50	85	141
44	173		

TABLE 5b

Compound No	Proton Chemical Shift δ in ppm ($CDCl_3$)
18	1.30,t,3H; 1.65,d,3H; 3.60,s,3H; 4.30,q,2H; 4.85,q,1H; 7.20,m,4H; 7.60,s,2H; 8.30,s,1H.
19	1.30,t,3H; 1.65,d,3H; 3.60,s,3H; 4.30,q,2H; 4.85,q,1H; 7.20,m,4H; 7.80,m,2H; 8.60,s,1H.
20	1.30,t,3H; 1.65,d,3H; 3.65,s,3H; 4.30,q,2H; 4.80,q,1H; 7.20,m,4H; 7.4-8.1,m,3H.
21	1.3,t,3H; 1.65,d,3H; 3.65,s,3H; 4.25,q,2H; 4.80,q,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
24	0.70-1.90,m,13H; 3.90-4.50,m,5H; 4.70,q,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
25	1.30,t,3H; 1.65,d,3H; 4.30,m,4H; 4.80,q,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
26	1.30,t,3H; 1.65,d,3H; 4.30,q,2H; 4.80,q,1H; 5.40,m,2H; 7.20,m,9H; 7.60,s,2H; 8.20,s,1H.
29	1.30,t,3H; 1.65,d,3H; 3.65,s,3H; 4.30,q,2H; 4.80,q,1H; 7.20,m,6H; 8.40,s,1H.
31	1.30,t,3H; 1.65,d,3H; 3.65,s,3H; 4.30,q,2H; 4.90,m,3H; 7.30,m,6H; 8.30,s,1H.
32	1.30,t,3H; 1.65,d,3H; 4.30,q,2H; 4.80,m,3H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
33	0.90,d,6H; 1.60,m,4H; 3.50,s,3H; 4.00,d,2H; 4.80,q,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
35	0.7-2.0,m,10H; 3.70,s,3H; 4.25,t,3H; 4.85,q,1H; 7.20,m,4H; 7.65,s,2H; 8.30,s,1H.
36	0.90,t,3H; 1.65,m,5H; 3.65,s,3H; 4.20,t,2H; 4.80,q,1H; 7.20,m,4H, 7.65,s,2H; 8.25,s,1H.

TABLE 5b (continued)

Compound No	Proton Chemical Shift δ in ppm ($CDCl_3$)
38	1.65,d,3H; 2.55,t,1H; 3.65,s,3H; 4.80,m,3H; 7.20,m,4H; 7.60,s,2H; 8.25,s,1H.
39	1.65,d,3H; 3.65,s,3H; 4.5-6.3,m,6H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
48	1.30,t,3H; 1.65,d,3H; 3.65,s,3H; 4.30,q,2H; 4.80,q,1H; 7.20,m,4H; 7.60,m,2H; 8.20,s,1H.
49	1.00,m,3H; 1.80,m,8H; 2.70,s,1H; 3.65,s,3H; 4.80,q,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
50	1.70,d,3H; 1.80,s,3H; 2.00,s,3H; 3.65,s,3H; 4.80,q,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
51	1.65,d,3H; 2.00,s,6H; 2.40,t,2H; 3.65,s,3H; 4.15,t,2H; 4.80,q,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
55	1.30,t,3H; 1.65,d,3H; 3.50,s,3H; 4.30,q,2H; 4.80,q,3H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
57	1.30,t,3H; 1.65,d,3H; 3.50,s,3H; 4.30,q,2H; 4.80,q,3H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
58	1.30,t,3H; 1.65,d,3H; 4.20,m,4H; 4.80,q,1H; 7.20,m,4H; 7.60,d,2H; 8.20,s,1H.
60	1.40,m,10H; 2.75,t,2H; 3.65,s,3H; 4.80,q,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
62	1.30,t,6H; 1.65,d,3H; 2.65,q,2H; 3.65,s,3H; 4.30,q,2H; 4.80,q,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
63	1.30,t,6H; 1.65,d,3H; 2.65,q,2H; 3.65,s,3H; 4.30,q,2H; 4.80,q,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.

TABLE 5b (continued)

Compound No	Proton Chemical Shift δ in ppm ($CDCl_3$)
66	0.90,t,3H; 1.65,m,5H; 3.50,s,3H; 4.20,t,2H; 4.85,q,1H; 7.20,m,4H; 7.60,m,2H; 8.25,s,1H.
68	1.30,m,6H; 1.65,d,3H; 2.45,s,3H; 4.20,m,4H; 4.85,q,1H; 7.20,m,4H; 7.60,m,2H; 8.10,s,1H.
70	0.7-2.0,m,10H; 2.90,t,2H; 3.55,s,3H; 4.80,q,1H; 7.20,m,4H; 7.60,s,2H; 8.30,s,1H.
71	1.40,m,10H; 2.90,t,2H; 3.65,s,3H; 4.80,q,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
72	1.65,d,3H; 3.65,s,3H; 4.60,d,2H; 4.80,q,1H; 5.90,t,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
73	1.00,t,3H; 1.30,t,3H; 1.70,m,5H; 4.20,m,4H; 4.80,q,1H; 7.20,m,4H; 7.60,s,1H; 8.35,s,1H.
78	1.40,m,10H; 3.50,s,3H; 4.30,t,2H; 4.80,s,2H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
80	1.30,m,6H; 2.00,m,2H; 3.65,s,3H; 4.30,q,2H; 4.80,q,1H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
81	1.30,t,3H; 1.70,s,6H; 3.65,s,3H; 4.30,q,2H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
83	1.40,m,10H; 2.80,t,2H; 3.65,s,3H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.
84	1.30,t,3H; 1.70,s,6H; 3.65,s,3H; 4.30,q,2H; 7.20,m,4H; 7.60,s,2H; 8.20,s,1H.

Example 25

Concentrated formulations of the compounds of the invention were prepared by:

a) in the case of oils and waxy solids, dissolving the compound in toluene containing 7% v/v "Teric" N13 ("Teric" is a Trade Mark and "Teric" N13, a product of ethoxylation of nonylphenol, is available from ICI Australia Limited) and 3% v/v "Kemmat" SC15B ("Kemmat" is a Trade Mark and "Kemmat" SC15B is a formulation of calcium dodecylbenzene sulfonate); or

b) in the case of crystalline solids, adding 5 parts by weight of the compound and 1 part by weight of "Dyapol" PT ("Dyapol" is a Trade Mark and "Dyapol" PT is an anionic suspending agent) to 94 parts by weight of an aqueous solution containing 0.25% v/v of "Teric" N8 (a product of ethoxylation of nonylphenol) and ball-milling the mixture to produce a stable suspension. The emulsifiable concentrates and suspensions were then diluted with water to give an aqueous composition of the required concentration suitable for use in the evaluation of the pre-emergence and post-emergence herbicidal activity of the compounds of the invention.

Example 26

The pre-emergent herbicidal activity of the compounds of the invention formulated as described in Example 25 was assessed by the following procedure.

The seeds of the test species were sown in rows 2 cm deep in soil contained in seed boxes. The monocotyledonous plants and the dicotyledonous plants were sown in separate boxes and after sowing the two boxes were sprayed with the required quantity of a composition of the invention. Two duplicate seed boxes were prepared in the same manner but were not sprayed with a composition of the invention and were used for comparison purposes. All the boxes were placed in a glasshouse, lightly watered with an overhead spray to initiate germination and then sub-irrigated as required for optimum plant growth. After three weeks the boxes were removed from the glasshouse and the effect of the treatment was visually assessed. The results are presented in Table 6 where the damage to plants is rated on a scale of from 0 to 3 where 0 represents from 0 to 25% damage, 3 represents 75 to 99% kill and 3+ represents 100% kill. A dash (-) means that no experiment was carried out.

The names of the test plants are as follows:

Wh	Wheat
Ot	Wild Oats
Rg	Ryegrass
Jm	Japanese millet
P	Peas
Ip	Ipomea
Ms	Mustard
Sf	Sunflower

TABLE 6

PRE-EMERGENCE HERBICIDAL ACTIVITY

Compound No	Application Rate kg/ha	Test Plant							
		Wh	Ot	Rg	Jm	P	Ip	Ms	Sf
1	5.0	3+	3+	3+	3+	0	0	0	0
1	1.0	2	2	3	3	0	0	0	0
3	5.0	3+	3+	3	3	0	0	0	0
3	1.0	1	2	1	3	0	0	0	0
3	0.5	0	3	2	2	0	0	0	0
15	5.0	3+	3+	3+	3+	0	0	0	0
15	1.0	3+	3+	3+	3+	0	0	0	0
15	0.5	2	1	2	3+	0	0	0	0
18	5.0	3	2	3	3+	0	0	0	0
18	1.0	3	0	3	3+	0	0	0	0
18	0.5	2	2	3	3	0	0	0	0
19	0.5	3	1	3	3+	0	0	0	0
20	0.5	1	0	2	3+	0	0	0	0
21	0.5	1	0	2	2	0	0	0	0
25	5.0	3	2	3	3+	0	0	0	0
25	1.0	0	0	0	0	0	0	0	0
27	5.0	0	1	3	3+	0	0	0	0
27	1.0	0	0	1	1	0	0	0	0
28	5.0	3+	3+	3+	3+	0	0	0	0
28	1.0	0	2	0	3+	0	0	0	0
29	5.0	3	1	2	3+	0	0	0	0
29	1.0	0	0	0	0	0	0	0	0
49	5.0	3	3+	3+	3+	0	0	0	0
49	1.0	0	0	1	0	0	0	0	0

TABLE 6 (continued)

Compound No	Application Rate kg/ha	Test Plant							
		Wh	Ot	Rg	Jm	P	Ip	Ms	Sf
50	5.0	3	3+	3+	3+	0	0	0	0
50	1.0	1	2	2	2	0	0	0	0
51	5.0	3	3+	3	3+	0	0	0	0
51	1.0	0	0	0	2	0	0	0	0
58	5.0	2	0	3	3	0	0	0	0
58	1.0	0	0	2	3	0	0	0	0
59	5.0	3+	3+	3+	3+	0	0	0	0
59	1.0	0	3+	3+	3+	0	0	0	0
59	0.5	1	2	2	2	0	0	0	0
59	0.25	0	0	0	0	0	0	0	0
60	5.0	3	3+	3+	3+	0	0	0	0
60	1.0	1	3	3	3+	0	0	0	0
60	0.5	0	1	2	3	0	0	0	0
60	0.25	0	0	2	0	0	0	0	0
66	2.5	3	3+	3+	3+	0	0	0	0
66	0.5	0	1	3	3	0	0	0	0
69	5.0	2	3	3+	3+	0	0	0	0
69	1.0	0	2	2	3+	0	0	0	0
70	2.5	3	3	3+	3+	0	0	0	0
70	0.5	0	1	2	3	0	0	0	0
71	5.0	3	3+	3+	3+	0	0	0	0
71	1.0	0	1	3+	3+	0	0	0	0
72	5.0	2	3	3+	3+	0	0	0	0
72	1.0	0	1	3+	3+	0	0	0	0
77	5.0	2	2	3+	3+	0	0	0	0
77	1.0	1	0	3+	3+	0	0	0	0

TABLE 6 (continued)

Compound No	Application Rate kg/ha	Test Plant							
		Wh	Ot	Rg	Jm	P	Ip	Ms	Sf
78	5.0	1	2	3	3	0	0	0	0
79	5.0	2	0	1	3	0	0	0	0
80	5.0	3	3	3+	3+	0	0	0	0
80	1.0	0	1	2	3	0	0	0	0
81	5.0	3	3+	3+	3+	0	0	0	0
81	1.0	0	1	1	3	0	0	0	0
82	5.0	1	3	3	3+	0	0	0	0
82	1.0	0	1	2	3+	0	0	0	0
83	5.0	1	3+	3+	3+	0	0	0	0
83	1.0	1	1	3	3+	0	0	0	0
84	5.0	2	3	3	3+	0	0	0	0
84	1.0	0	3+	3	3+	0	0	0	0
84	0.5	0	1	3+	3+	0	0	0	0
84	0.25	0	0	0	1	0	0	0	0

Example 27

The post-emergent herbicidal activity of the compounds of the invention formulated as described in Example 25 was assessed by the following procedure.

The seeds of the test species were sown in rows 2 cm deep in soil contained in seed boxes. The monocotyledonous plants and the dicotyledonous plants were sown in separate seed boxes in duplicate. The four seed boxes were placed in a glasshouse, lightly watered with an overhead spray to initiate germination and then sub-irrigated as required for optimum plant growth. After the plants had grown to a height of about 10 to 12.5 cm one box of each of the monocotyledonous plants and the dicotyledonous plants was removed from the glasshouse and sprayed with the required quantity of a composition of the invention. After spraying the boxes were returned to the glasshouse for a further 3 weeks and the effect of treatment was visually assessed by comparison with the untreated controls. The results are presented in Table 7 where the damage to plants is rated on a scale of from 0 to 3 where 0 represents 0 to 25% damage, 3 represents 75 to 99% kill and 3+ represents 100% kill. A dash (-) means that no experiment was carried out.

The names of the test plants are as follows:

Wh	Wheat
Ot	Wild Oats
Rg	Ryegrass
Jm	Japanese millet
P	Peas
Ip	Ipomea
Ms	Mustard
Sf	Sunflower

TABLE 7

POST-EMERGENCE HERBICIDAL ACTIVITY

Compound No	Application Rate kg/ha	Test Plant							
		Wh	Ot	Rg	Jm	P	Ip	Ms	Sf
1	5.0	3+	3+	3+	3+	0	0	0	0
1	1.0	3	3+	3	3+	0	0	0	0
3	5.0	3+	3+	3+	3+	0	0	0	0
3	1.0	3+	3+	3+	3+	0	0	0	0
3	0.5	3+	3+	3+	3+	0	0	0	0
15	5.0	3+	3+	3+	3+	0	0	0	0
15	1.0	3	3+	3+	3+	0	0	0	0
15	0.5	3+	3+	3+	3+	0	0	0	0
18	5.0	3+	3+	3+	3+	0	0	0	0
18	1.0	3+	3+	3+	3+	0	0	0	0
18	0.5	3+	3+	3+	3+	0	0	0	0
19	0.5	3+	3+	3+	3+	0	0	0	0
20	0.5	3+	3+	3+	3+	0	0	0	0
21	0.5	3+	3+	3+	3+	0	0	0	0
25	5.0	3+	3+	3+	3+	0	0	0	0
25	1.0	3+	3+	3+	3+	0	0	0	0
27	5.0	3+	3	3+	3+	0	0	0	0
27	1.0	1	3	3+	3+	0	0	0	0
28	5.0	3+	3+	3+	3+	0	0	0	0
28	1.0	3+	3+	3+	3+	0	0	0	0
29	5.0	3+	3+	3+	3+	0	0	0	0
29	1.0	3+	3	3	3+	0	0	0	0
49	5.0	3+	3+	3+	3+	0	0	0	0
49	1.0	3+	3+	3+	3+	0	0	0	0

TABLE 7 (continued)

Compound No	Application Rate kg/ha	Test Plant							
		Wh	Ot	Rg	Jm	P	Ip	Ms	Sf
50	5.0	3+	3+	3+	3+	0	0	0	0
50	1.0	3+	3+	3+	3+	0	0	0	0
51	5.0	3+	3+	3+	3+	0	0	0	0
51	1.0	3+	3+	3+	3+	0	0	0	0
58	5.0	3+	3+	3+	3+	0	0	0	0
58	1.0	3+	3+	3+	3+	0	0	0	0
59	5.0	3+	3+	3+	3+	0	0	0	0
59	1.0	3+	3+	3+	3+	0	0	0	0
59	0.5	3+	3+	3+	3+	0	0	0	0
59	0.25	3	3+	3+	3+	0	0	0	0
60	5.0	3+	3+	3+	3+	0	0	0	0
60	1.0	3+	3+	3+	3+	0	0	0	0
60	0.5	3+	3+	3+	3+	0	0	0	0
60	0.25	3+	3+	3+	3+	0	0	0	0
66	2.5	3+	3+	3+	3+	0	0	0	0
66	0.5	3+	3+	3+	3+	0	0	0	0
69	5.0	3+	3+	3+	3+	0	0	0	0
69	1.0	3+	3+	3+	3+	0	0	0	0
70	2.5	3+	3+	3+	3+	0	0	0	0
70	0.5	3+	3+	3+	3+	0	0	0	0
71	5.0	3+	3+	3+	3+	0	0	0	0
71	1.0	3+	3+	3+	3+	0	0	0	0
72	5.0	3+	3+	3+	3+	0	0	0	0
72	1.0	3+	3+	3+	3+	0	0	0	0
77	5.0	3+	3+	3	3+	0	0	0	0
77	1.0	3	3	3	3+	0	0	0	0

TABLE 7 (continued)

Compound No	Application Rate kg/ha	Test Plant							
		Wh	Ot	Rg	Jm	P	Ip	Ms	Sf
78	5.0	3	3+	3+	3+	0	0	0	0
79	5.0	3	3	3	3+	0	0	0	0
80	5.0	3+	3+	3+	3+	0	0	0	0
80	1.0	3+	3+	3+	3+	0	0	0	0
81	5.0	3+	3+	3+	3+	0	2	2	2
81	1.0	3	3+	3+	3+	0	0	0	0
82	5.0	3	3+	3+	3+	0	0	0	0
82	1.0	2	3+	3+	3+	0	0	0	0
83	5.0	3+	3+	3+	3+	0	0	0	0
83	1.0	3+	3+	3+	3+	0	0	0	0
84	5.0	3+	3+	3+	3+	0	0	0	0
84	1.0	3+	3+	3+	3+	0	0	0	0
84	0.5	3+	3+	3+	3+	0	0	0	0
84	0.25	3+	3+	3+	3+	0	0	0	0

Example 28

The compounds were formulated for test by mixing an appropriate amount with 5 ml of an emulsion prepared by diluting 160 ml of a solution containing 21.8 g per litre of "Span" 80 and 78.2 g per litre of "Tween" 20 in methylcyclohexanone to 500 ml with water. "Span" 80 is a Trade Mark for a surface-active agent comprising sorbitan monolaurate. "Tween" 20 is a Trade Mark for a surface-active agent comprising a condensate of sorbitan monolaurate with 20 molar proportions of ethylene oxide. Each 5 ml emulsion containing a test compound was then diluted to 40 ml with water and sprayed on to young pot plants (post-emergence test) of the species named in Table 8 below. Damage to test plants was assessed after 14 days on a scale of 0 to 5 where 0 is 0 to 20% damage and 5 is complete kill. In a test for pre-emergence herbicidal acitivity, seeds of the test plants were sown in a shallow slit formed in the surface of soil in fibre trays. The surface was then levelled and sprayed, and fresh soil then spread thinly over the sprayed surface. Assessment of herbicidal damage was carried out after 21 days using the same scale of 0 to 5 as the post-emergence test. In both cases the degree of herbicidal damage was assessed by comparison with untreated control plants. The results are given in Table 8 below. A dash (-) means that no experiment was carried out.

The names of the test plants were as follows:

Sb	Sugar beet
Rp	Rape
Ct	Cotton
Sy	Soy bean
Mz	Maize
Mw	Winter wheat
Rc	Rice
Sn	Senecio vulgaris
Ip	Ipomea purpurea
Am	Amaranthus retroflexus
Pi	Polygonum aviculare
Ca	Chenopodium album
Po	Portulaca oleracea
Ga	Galium aparine
Xa	Xanthium pensylvanicum
Ab	Abutilon theophrasti
Cv	Convolvulus arvensis
Co	Cassia obtusifolia
Av	Avena fatua
Dg	Digitaria sanguinalis
Pu	Poa annua
Al	Alopecurus myosuroides
St	Setaria viridis
Ec	Echinochloa crus-galli
Sh	Sorghum halepense
Ag	Agropyron repens
Cn	Cyperus rotundas

TABLE 8 - PART A

Compound No	APPLICATION Method	Rate (kg/ha)	Test Plant											
			Sb	Rp	Ct	Sy	Mz	Ww	Rc	Sn	Ip	Am	Pi	Ca
1	PRE	2.0	0	0	0	0	5	5	5	0	0	2	0	-
1	PRE	0.5	0	1	0	0	4	5	3	0	0	0	0	-
1	PRE	0.05	0	0	-	0	-	2	0	0	1	0	0	0
1	POST	2.0	1	2	0	2	5	4	4	-	0	1	0	0
1	POST	0.5	0	0	0	1	5	4	4	-	0	0	0	0
1	POST	0.05	0	0	0	0	4	4	3	0	0	1	0	0
3	PRE	2.0	0	0	0	0	5	5	5	1	0	0	0	0
3	PRE	0.5	0	1	0	1	4	5	4	0	0	0	0	0
3	PRE	0.05	0	0	0	0	0	3	1	0	0	0	1	0
3	POST	2.0	0	2	1	3	5	4	5	2	0	1	0	1
3	POST	0.5	1	0	0	0	4	4	4	2	0	0	0	1
3	POST	0.05	0	0	0	-	4	4	4	1	0	0	0	0
17	POST	0.01	0	0	0	0	4	4	1	0	0	0	0	0
25	PRE	0.2	0	0	0	0	2	2	0	0	0	0	0	0
25	PRE	0.05	0	0	0	0	0	0	0	0	0	0	0	0
25	POST	0.2	0	1	0	0	5	4	1	0	0	0	0	-
25	POST	0.05	0	1	0	0	4	3	0	0	0	0	0	-
50	PRE	0.05	-	-	-	-	1	3	1	-	-	-	-	-
50	POST	0.05	-	-	-	-	5	4	2	-	-	-	-	-
77	PRE	2.0	-	-	-	-	3	4	5	-	-	-	-	-
77	PRE	0.5	-	-	-	-	0	3	2	-	-	-	-	-
77	POST	2.0	-	-	-	-	4	4	2	-	-	-	-	-
77	POST	0.5	-	-	-	-	3	4	3	-	-	-	-	-
58	PRE	0.2	-	-	-	-	0	1	0	-	-	-	-	-
58	PRE	0.05	-	-	-	-	0	0	0	-	-	-	-	-

TABLE 8 - PART A (continued)

Compound No	APPLICATION Method	Rate (kg/ha)	Test Plant											
			Sb	Rp	Ct	Sy	Mz	Ww	Rc	Sn	Ip	Am	Pi	Ca
58	POST	0.2	-	-	-	-	4	4	1	-	-	-	-	-
58	POST	0.05	-	-	-	-	4	2	0	-	-	-	-	-
59	PRE	1.0	0	0	0	0	4	4	4	0	0	0	-	0
59	PRE	0.2	1	0	0	0	3	4	4	0	0	0	-	0
59	POST	1.0	0	0	0	0	5	4	4	1	0	-	-	1
59	POST	0.2	0	0	0	0	4	4	4	0	0	-	-	0
84	PRE	2.0	-	-	-	-	0	3	1	-	-	-	-	-
84	PRE	0.5	-	-	-	-	0	2	1	-	-	-	-	-
84	POST	2.0	-	-	-	-	5	4	3	-	-	-	-	-
84	POST	0.5	-	-	-	-	4	4	3	-	-	-	-	-

TABLE 8 - PART B

Compound No	APPLICATION Method	Rate (kg/ha)	Test Plant											
			Po	Xa	Ab	Cv	Av	Dg	Pu	St	Ec	Sh	Ag	Cn
1	PRE	2.0	0	0	0	-	4	5	5	5	5	4	5	0
1	PRE	0.5	0	0	0	-	4	5	5	5	3	4	5	0
1	PRE	0.05	0	-	0	-	0	3	0	4	1	0	0	0
1	POST	2.0	0	1	0	0	5	5	4	5	5	5	5	0
1	POST	0.5	0	1	0	0	5	5	4	4	5	5	5	0
1	POST	0.05	-	0	0	0	4	4	4	4	5	4	4	-
3	PRE	2.0	0	0	0	-	5	5	5	5	5	4	5	0
3	PRE	0.5	0	1	0	-	4	5	4	5	5	4	5	0
3	PRE	0.05	0	0	0	-	0	0	0	0	0	-	2	0
3	POST	2.0	1	2	0	0	5	5	4	5	5	5	4	0
3	POST	0.5	0	0	0	0	5	5	4	5	5	5	4	0
3	POST	0.05	-	0	0	0	4	5	3	5	5	5	4	0
17	POST	0.01	0	0	0	0	2	3	0	5	1	4	1	0
25	PRE	0.2	0	0	-	-	0	1	0	4	1	0	1	0
25	PRE	0.05	0	0	0	0	0	0	0	2	0	0	0	0
25	POST	0.2	0	0	0	-	4	4	0	4	5	4	4	0
25	POST	0.05	0	0	0	-	3	4	1	3	4	4	1	0
50	PRE	0.05	-	-	-	-	0	1	-	0	0	0	2	-
50	POST	0.05	-	-	-	-	4	4	-	4	4	4	3	-

TABLE 8 - PART B (continued)

Compound No	APPLICATION Method	Rate (kg/ha)	Test Plant											
			Ga	Xa	Ab	Co	Av	Dg	Al	St	Ec	Sh	Ag	Cn
77	PRE	2.0	-	-	-	-	4	5	5	5	5	4	5	-
77	PRE	0.5	-	-	-	-	3	4	5	4	3	3	3	-
77	POST	2.0	-	-	-	-	5	5	4	5	5	5	4	-
77	POST	0.5	-	-	-	-	4	3	5	5	5	5	3	-
58	PRE	0.2	-	-	-	-	0	1	0	1	0	2	3	-
58	PRE	0.05	-	-	-	-	0	1	0	0	0	3	0	-
58	POST	0.2	-	-	-	-	4	4	3	3	4	4	2	-
58	POST	0.05	-	-	-	-	1	2	0	2	0	3	0	-
59	PRE	1.0	-	0	1	0	0	-	-	-	5	4	5	-
59	PRE	0.2	-	0	1	0	0	-	-	-	5	3	5	-
59	POST	1.0	0	0	0	0	5	5	4	5	5	5	4	-
59	POST	0.2	0	0	0	0	4	4	4	4	5	4	4	-
84	PRE	2.0	-	-	-	-	3	3	4	2	3	3	5	-
84	PRE	0.5	-	-	-	-	3	3	4	2	2	3	5	-
84	POST	2.0	-	-	-	-	4	4	4	3	5	4	4	-
84	POST	0.5	-	-	-	-	4	2	4	5	5	3	4	-

Example 29

This Example illustrates the selective herbicidal acitivity of compounds of the invention when applied in the field.

The test compound was formulated following essentially the same procedure described in Example 28.

The seeds of the test plant species were sown using a Stanhay Precision Seeder on flat-topped hills spaced 1 metre apart. Two species were sown on each hill. The flat-topped hills were grouped in sub-plots on the basis of the rate of application of the test chemical. The species were sown at different times so that they would all reach approximately the same stage of growth at the same time.

Each flat-topped hill to be sprayed with the formulated test compound was pegged to a 1.25 metre centre and sprayed to a width of 1 metre using an Oxford Precision Sprayer fitted with two No "O" T-jets.

In the pre-emergence test the flat-topped hills were sprayed with the test compound after sowing and the damage to the test plants was visually assessed 14, 21, 35 and 63 days after spraying. The results, expressed as percentage kill, are given in Table 9 Part A.

In the post-emergence test the flat-topped hills were sprayed with the test compound after the test plants had reached the 2-3 leaf stage and the damage was visually assessed 7, 14, 28 and 56 days after spraying. The results, expressed as percentage kill, are given in Table 9 Part B.

The names of the test plants were as follows:

Sy	Soya bean	(Bethal)
Ct	Cotton	(Delta Pine 16)
Pn	Peanut	(Red Spanish)
Mz	Maize	(XL 45)

Ss	Setaria anceps
Dg	Digitaria sanguinalis
Ec	Echinochloa crus-galli
Sg	Sorghum (Goldrush)
Sh	Sorghum Halepense

TABLE 9 - PART A

PRE-EMERGENCE FIELD TEST

Compound No	Rate (kg/ha)	DAT*	Percentage Kill of the Test Plants								
			Sy	Ct	Pn	Mz	Ss	Dg	Ec	Sg	Sh
18	2.0	14	0	0	0	100	-	-	-	100	-
18	2.0	21	3	15	8	100	100	100	100	100	100
18	2.0	35	0	0	0	100	100	100	100	100	100
18	2.0	63	0	0	8	100	100	100	100	100	100
18	1.0	14	0	0	0	100	-	-	-	100	-
18	1.0	21	3	5	10	100	100	100	100	100	100
18	1.0	35	0	0	3	100	100	100	100	100	100
18	1.0	63	0	0	5	100	100	100	100	100	100
18	0.5	14	0	0	3	75	-	-	-	91	-
18	0.5	21	0	0	3	90	100	100	100	98	100
18	0.5	35	0	0	0	83	100	100	100	100	100
18	0.5	63	0	0	0	80	100	100	100	95	100
UC+	-	14	0	0	0	0	-	-	-	0	-
UC	-	21	0	0	0	0	0	0	0	0	0
UC	-	35	0	0	0	0	0	0	0	0	0
UC	-	63	0	0	0	0	0	0	0	0	0

* DAT - Number of Days After Treatment that assessment was made

\+ UC - Untreated Controls

TABLE 9 - PART A (continued)

Compound No	Rate (kg/ha)	DAT*	Percentage Kill of the Test Plants								
			Sy	Ct	Pn	Mz	Ss	Dg	Ec	Sg	Sh
21	2.0	14	0	0	0	100	-	-	-	100	-
21	2.0	21	0	0	5	100	100	100	100	100	100
21	2.0	35	0	0	3	100	100	100	100	100	100
21	2.0	63	0	0	0	100	100	100	100	100	100
21	1.0	14	0	0	0	100	-	-	-	100	-
21	1.0	21	0	5	3	100	100	100	100	100	100
21	1.0	35	0	0	3	100	100	100	100	100	100
21	1.0	63	0	0	0	100	100	100	100	100	100
21	0.5	14	0	0	2	53	-	-	-	89	-
21	0.5	21	0	5	5	58	100	100	100	85	100
21	0.5	35	0	0	3	45	100	100	100	75	100
21	0.5	63	0	0	0	45	100	100	100	73	100
UC+	-	14	0	0	0	0	-	-	-	0	-
UC	-	21	0	0	0	0	0	0	0	0	0
UC	-	35	0	0	0	0	0	0	0	0	0
UC	-	63	0	0	0	0	0	0	0	0	0

* DAT - Number of Days After Treatment that assessment was made

\+ UC - Untreated Controls

TABLE 9 - PART B

POST-EMERGENCE FIELD TEST

Compound No	Rate (kg/ha)	DAT*	Percentage Kill of the Test Plants								
			Sy	Ct	Pn	Mz	Ss	Dg	Ec	Sg	Sh
18	2.0	7	8	5	3	80	65	65	58	83	85
18	2.0	14	8	0	3	100	93	100	100	100	100
18	2.0	28	13	0	0	100	100	100	100	100	100
18	2.0	56	0	0	0	100	100	100	100	100	100
18	1.0	7	0	0	0	68	63	65	63	77	80
18	1.0	14	0	0	5	100	85	97	100	100	100
18	1.0	28	0	0	0	100	98	100	100	100	100
18	1.0	56	0	0	0	100	100	100	100	100	100
18	0.5	7	0	0	3	48	58	50	65	70	75
18	0.5	14	3	0	0	98	90	90	100	100	100
18	0.5	28	0	0	0	100	88	92	100	100	100
18	0.5	56	0	0	0	100	98	98	100	100	100
UC+	-	7	0	0	3	0	0	0	0	0	0
UC	-	14	0	0	0	0	0	0	0	0	0
UC	-	28	5	0	0	0	0	0	0	0	0
UC	-	56	5	0	0	0	0	0	0	0	0

* DAT - Number of Days After Treatment that assessment was made

\+ UC - Untreated Controls

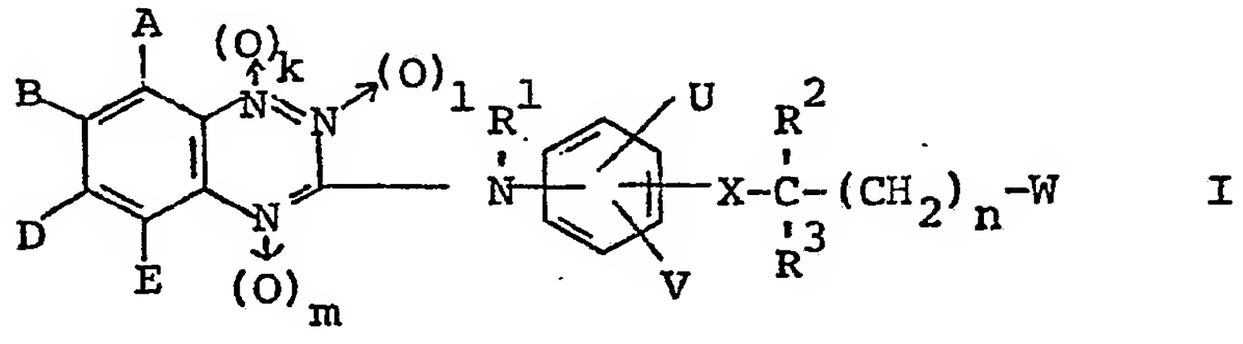
TABLE 9 - PART B (continued)

Compound No	Rate (kg/ha)	DAT*	Percentage Kill of the Test Plants								
			Sy	Ct	Pn	Mz	Ss	Dg	Ec	Sg	Sh
21	2.0	7	13	3	5	78	68	78	78	90	93
21	2.0	14	10	8	0	100	100	100	100	100	100
21	2.0	28	15	13	0	100	100	100	100	100	100
21	2.0	56	3	5	0	100	100	100	100	100	100
21	1.0	7	5	3	3	80	33	68	60	65	-
21	1.0	14	0	3	0	100	90	99	100	100	-
21	1.0	28	5	3	0	100	100	100	100	100	-
21	1.0	56	0	0	0	100	100	100	100	100	-
21	0.5	7	10	0	3	88	53	68	60	88	53
21	0.5	14	3	0	0	100	85	85	100	100	100
21	0.5	28	3	0	0	100	90	100	100	100	100
21	0.5	56	0	0	0	100	93	100	100	100	100
UC+	-	7	0	0	0	0	0	0	0	0	0
UC	-	14	0	0	0	0	0	0	0	0	0
UC	-	28	5	0	0	0	0	0	0	0	0
UC	-	56	5	0	0	0	0	0	0	0	0

* DAT - Number of Days After Treatment that assessment was made

\+ UC - Untreated Controls

1. A compound of formula I



I

or a salt thereof wherein:

A, B, D, E, U and V are independently chosen from the group consisting of hydrogen, halogen, nitro, cyano, thiocyano, amino, C_1 to C_6 alkylamino, di(C_1 to C_6 alkyl)amino, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl, C_2 to C_6 alkenyl, C_3 to C_7 cycloalkyl, C_1 to C_6 alkoxy, C_1 to C_6 haloalkoxy, C_1 to C_6 alkylthio, C_1 to C_6 alkylsulfinyl, C_1 to C_6 alkylsulfonyl, C_1 to C_6 haloalkylsulfinyl, C_1 to C_6 haloalkylsulfonyl, sulfo, C_1 to C_6 alkoxysulfonyl, sulfamoyl, N-(C_1 to C_6 alkyl) sulfamoyl, N,N-di(C_1 to C_6 alkyl)sulfamoyl, carboxy, (C_1 to C_6 alkoxy)carbonyl, carbamoyl, N-(C_1 to C_6 alkyl)carbamoyl, N,N-di(C_1 to C_6 alkyl)carbamoyl, phenyl, phenoxy, phenylthio, and the groups substituted phenyl, substituted phenoxy and substituted phenylthio wherein in each group the phenyl ring is substituted with from one to three substituents chosen from the group consisting of halogen, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl, C_1 to C_6 alkoxy, nitro and cyano;

R^1 is chosen from the group consisting of hydrogen, C_1 to C_{10} alkyl, C_2 to C_{10} alkenyl, C_2 to C_{10} alkynyl, C_2 to C_{10} alkoxyalkyl, cyanomethylene, (C_1 to C_6 alkoxy)-carbonylmethylene, C_1 to C_{10} haloalkyl, formyl, C_2 to C_{10} alkanoyl, phenyl, benzyl, benzoyl, and the groups phenyl, benzyl and benzoyl wherein in each group the phenyl ring is substituted with from one to three substi-

tuents chosen from the group consisting of halogen, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl, C_1 to C_6 alkoxy, nitro and cyano;

R^2 is chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkenyl, C_2 to C_6 alkoxyalkyl, C_1 to C_6 haloalkyl, acetyl, propionyl, and C_2 to C_6 alkoxycarbonyl;

R^3 is chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkenyl, C_2 to C_6 alkoxyalkyl and C_1 to C_6 haloalkyl, or R^2 and R^3 together may form a methylene, ethylidene, propylidene or isopropylidene group;

W is chosen from the group consisting of cyano, thiocarbamoyl, $-\overset{O}{\overset{\|}{C}}-G$ and CH_2Z wherein:

G is chosen from the group consisting of hydroxy, mercapto, C_1 to C_{10} alkoxy, C_1 to C_{10} haloalkoxy, C_2 to C_{10} alkenyloxy, C_2 to C_{10} alkynyloxy, C_1 to C_{10} alkylthio, C_2 to C_{10} alkenylthio, C_2 to C_{10} alkynylthio, C_3 to C_7 cycloalkoxy, C_3 to C_7 cycloalkoxy substituted with one or two C_1 to C_4 alkyl groups, phenoxy, phenylthio, benzyloxy, benzylthio, the group C_1 to C_6 alkoxy substituted with a substituent chosen from the group consisting of C_1 to C_6 alkoxy, amino, ammonio, cyano, N-(C_1 to C_6 alkyl)amino, N,N-di(C_1 to C_6 alkyl)amino, and N,N,N-tri(C_1 to C_6 alkyl)ammonio, the groups phenoxy, phenylthio, benzyloxy and benzylthio wherein in each group the phenyl ring is substituted with from one to three substituents chosen from the group consisting of halogen, nitro, cyano, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl and C_1 to C_6 alkoxy, the group OM wherein M is the cation of an inorganic or organic base, the group $-NHSO_2R^4$ wherein R^4 is chosen from C_1 to C_{10} alkyl and C_1 to C_{10} haloalkyl, and the group $-NR^5R^6$ wherein R^5 and R^6 are in-

dependently chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_1 to C_6 hydroxyalkyl, C_1 to C_6 haloalkyl, phenyl, and benzyl or R^5 and R^6 together form a heterocyclic ring, and the group $-O-N=R^{10}$ wherein R^{10} is a C_1 to C_{10} alkylidene group; and Z is chosen from halogen, hydroxy, mercapto, C_1 to C_{10} alkoxy, C_1 to C_{10} haloalkoxy, C_1 to C_{10} alkylthio and the group NR^5R^6 wherein R^5 and R^6 are as hereinbefore defined;

X is chosen from oxygen and sulfur;

k, l and m are independently chosen from 0 and 1 provided that k+l+m is 0, 1 or 2; and

n is 0, 1 or 2.

2. A compound according to claim 1 wherein:

A, B, D, E, U and V are independently chosen from the group consisting of hydrogen, halogen, nitro, cyano, thiocyano, amino, C_1 to C_6 alkylamino, di(C_1 to C_6 alkyl)-amino, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl, C_2 to C_6 alkenyl, C_3 to C_7 cycloalkyl, C_1 to C_6 alkoxy, C_1 to C_6 alkylthio, C_1 to C_6 alkylsulfinyl, C_1 to C_6 alkylsulfonyl, (C_1 to C_6 alkoxy)carbonyl, phenyl, phenoxy, phenylthio, and the groups substituted phenyl, substituted phenoxy and substituted phenylthio wherein in each group the phenyl ring is substituted with from one to three substituents chosen from the group consisting of halogen, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl, C_1 to C_6 alkoxy, nitro and cyano;

R^1 is chosen from the group consistingof hydrogen, C_1 to C_{10} alkyl, C_2 to C_{10} alkenyl, C_2 to C_{10} alkoxyalkyl, C_1 to C_{10} haloalkyl, formyl, C_2 to C_{10} alkanoyl, phenyl, benzyl, benzoyl, and the groups phenyl, benzyl and benzoyl wherein in each group the phenyl ring is substituted with one or two substituents chosen from the group consisting of halogen, C_1 to C_6 alkyl, C_1 to C_6 halo-

alkyl, C_1 to C_6 alkoxy, nitro and cyano;

R^2 is chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkenyl, C_2 to C_6 alkoxyalkyl, C_1 to C_6 haloalkyl, acetyl, propionyl and (C_1 to C_6 alkoxy)-carbonyl;

R^3 is chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkenyl, C_2 to C_6 alkoxyalkyl, and C_1 to C_6 haloalkyl or R^2 and R^3 together form a methylene, ethylidene, propylidene or isopropylidene group;

W is chosen from the group consisting of cyano, thiocarbamoyl, $-\overset{O}{\overset{\|}{C}}-G$ and $-CH_2Z$ wherein:

G is chosen from the group consisting of hydroxy, mercapto, C_1 to C_{10} alkoxy, C_1 to C_{10} haloalkoxy, C_2 to C_{10} alkenyloxy, C_2 to C_{10} alkynyloxy, C_1 to C_{10} alkylthio, C_2 to C_{10} alkenylthio, C_3 to C_7 cycloalkoxy, C_3 to C_7 cycloalkoxy substituted with one or two C_1 to C_4 alkyl groups, phenoxy, phenylthio, benzyloxy, benzylthio, the group C_1 to C_{10} alkoxy substituted with an hydroxy or a C_1 to C_6 alkoxy group, the groups phenoxy, phenylthio, benzyloxy and benzylthio wherein in each group the phenyl ring is substituted with one or two substituents chosen from the group consisting of halogen, nitro, cyano, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl and C_1 to C_6 alkoxy, the group OM wherein M is the cation of an inorganic or organic base, the group $-NHSO_2R^4$ wherein R^4 is chosen from C_1 to C_{10} alkyl and C_1 to C_{10} haloalkyl, and the group $-NR^5R^6$ wherein R^5 and R^6 are independently chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl, C_1 to C_6 hydroxyalkyl, phenyl and benzyl, or R^5 and R^6 together form a heterocyclic ring; and Z is chosen from halogen, hydroxy, mercapto, C_1 to C_{10} alkoxy, C_1 to C_{10} haloalkoxy, C_1 to C_{10} alkyl-

thio and the group NR^5R^6 wherein R^5 and R^6 are independently chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl, C_1 to C_6 hydroxyalkyl, phenyl and benzyl, or R^5 and R^6 together form a heterocyclic ring;

X is chosen from oxygen and sulfur;

k, l and m are indpendently chosen from 0 and 1 provided that k+l+m is 0 or 1; and

n is 0, 1 or 2.

3. A compound according to claim 1 wherein:

A, B, D and E are independently chosen from the group consisting of hydrogen, halogen, nitro, cyano, amino, C_1 to C_6 alkylamino, di(C_1 to C_6 alkyl)amino, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl, C_2 to C_6 alkenyl, C_1 to C_6 alkoxy, C_1 to C_6 haloalkoxy, C_1 to C_6 alkylthio, carboxy and (C_1 to C_6 alkoxy)carbonyl;

U and V are independently chosen from the group consisting of hydrogen, halogen, nitro, cyano, C_1 to C_6 alkyl and C_1 to C_6 haloalkyl;

R^1 is chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkenyl, C_2 to C_6 alkynyl, benzyl, (C_1 to C_6 alkoxy)carbonylmethylene and cyanomethylene;

R^2 is chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkoxyalkyl and (C_1 to C_6 alkoxy)-carbonyl;

R^3 is chosen from hydrogen and C_1 to C_6 alkyl;

W is chosen from the group $-\overset{O}{\overset{\|}{C}}-G$ and $-CH_2Z$ wherein:

G is chosen from the group consisting of hydroxy, C_1 to C_{10} alkoxy, C_1 to C_{10} haloalkoxy, C_2 to C_{10} alkenyloxy, C_2 to C_{10} alkynyloxy, C_1 to C_{10} alkylthio, C_2 to C_{10}

alkenylthio, C_2 to C_{10} alkynylthio, cyclohexyloxy, phenoxy, benzyloxy, the group C_1 to C_{10} alkoxy substituted with a substituent chosen from the group consisting of C_1 to C_6 alkoxy, amino, N-(C_1 to C_6 alkyl)-amino, N,N-di(C_1 to C_6 alkyl)amino and N,N,N-tri-(C_1 to C_6 alkyl)ammonio, the group $-NR^5R^6$ wherein R^5 and R^6 are independently chosen from hydrogen, C_1 to C_6 alkyl, C_1 to C_6 hydroxyalkyl, C_1 to C_6 haloalkyl and phenyl, the group OM wherein M is an alkali metal ion, alkaline earth metal ion or an ammonium ion $H\overset{\oplus}{N}R^7R^8R^9$ wherein R^7, R^8 and R^9 are independently chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_1 to C_6 hydroxyalkyl, phenyl and benzyl, the group $-NHSO_2R^4$ wherein R^4 is C_1 to C_6 alkyl, and the group $-O-N=R^{10}$ wherein R^{10} is a C_1 to C_{10} alkylidene group; and Z is chosen from the group consisting of halogen, hydroxy, mercapto, C_1 to C_{10} alkoxy, and the group $-NR^5R^6$ wherein R^5 and R^6 are independently chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_1 to C_6 hydroxyalkyl, C_1 to C_6 haloalkyl and phenyl;

X is oxygen;

k, l and m are independently chosen from 0 and 1 provided that k+l+m is 0 or 1; and

n is 0 or 2.

4. A compound according to claim 1 or claim 3 wherein:

A, B, D and E are independently chosen from the group consisting of hydrogen, halogen, C_1 to C_6 alkyl, C_1 to C_6 haloalkyl and C_1 to C_6 alkoxy;

U and V are independently chosen from hydrogen and halogen;

R^1 is chosen from the group consisting of hydrogen, C_1 to C_6 alkyl, C_2 to C_6 alkynyl, benzyl, (C_1 to C_6

alkoxy)carbonylmethylene and cyanomethylene;

R^2 is chosen from the group consisting of hydrogen, C_1 to C_6 alkyl and C_2 to C_6 alkoxyalkyl;

R^3 is chosen from hydrogen and C_1 to C_6 alkyl;

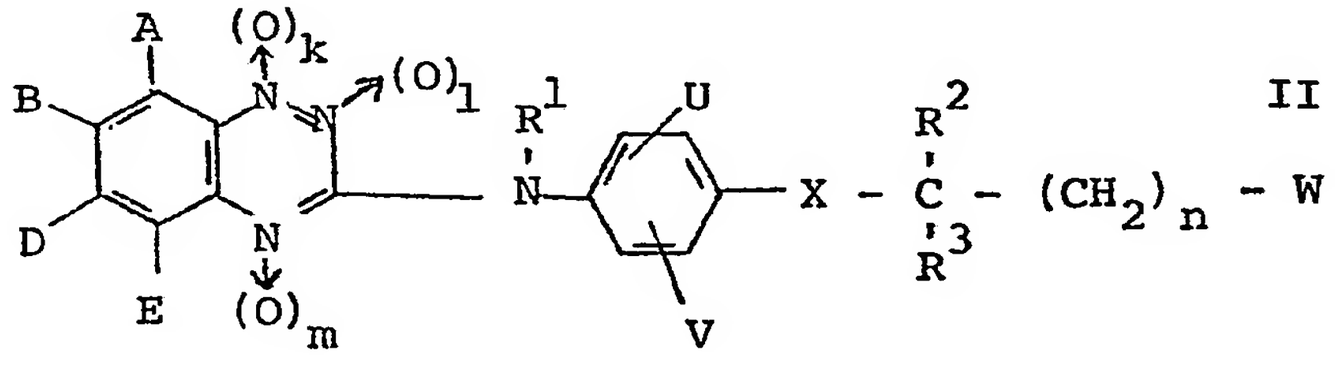
W is the group $-\overset{O}{\overset{\|}{C}}-G$ wherein G is chosen from the group consisting of hydroxy, C_1 to C_{10} alkoxy, C_2 to C_{10} alkenyloxy, C_2 to C_{10} alkynyloxy, C_1 to C_{10} alkylthio, C_1 to C_{10} haloalkoxy, the group C_1 to C_{10} alkoxy substituted with a substituent chosen from the group consisting of amino, N-(C_1 to C_6 alkyl)amino, N,N-di(C_1 to C_6 alkyl)amino and N,N,N-tri(C_1 to C_6 alkyl)ammonio, the group $-O-N=R^{10}$ wherein R^{10} is a C_1 to C_{10} alkylidene group, the group OM wherein M is an alkali metal ion or an alkaline earth metal ion, and the group $-NR^5R^6$ wherein R^5 and R^6 are independently chosen from hydrogen, C_1 to C_6 alkyl, C_1 to C_6 hydroxyalkyl and C_1 to C_6 haloalkyl;

X is oxygen;

m is 0, k and l are independently chosen from 0 and 1 and k + l is 0 or 1; and

n is 0.

5. A compound according to any one of claims 1 to 4 inclusive of formula II



6. A compound according to any one of claims 1 or 3 to 5 inclusive wherein:

A, E and V are hydrogen;

B is chosen from the group consisting of hydrogen, halogen, C_1 to C_6 alkyl, C_1 to C_6 alkoxy and C_1 to C_6 haloalkyl;

D and U are independently chosen from hydrogen and halogen;

R^1, R^2 and R^3 are independently chosen from hydrogen and C_1 to C_6 alkyl;

W is the group $-\overset{O}{\overset{\|}{C}}-G$ wherein G is chosen from the group consisting of hydroxy, C_1 to C_{10} alkoxy, C_2 to C_{10} alkenyloxy, C_2 to C_{10} alkynyloxy, C_1 to C_{10} alkylthio, C_1 to C_{10} haloalkoxy, the group C_1 to C_{10} alkoxy substituted with the substituent N,N-di(C_1 to C_6 alkyl)amino, the group $-O-N=R^{10}$ wherein R^{10} is a C_1 to C_{10} alkylidene group, and the group OM wherein M is an alkali metal ion;

X is oxygen;

m is 0, k and l are independently chosen from 0 and 1 and k+l+m is 0 or 1, and n is 0.

7. A compound according to any one of claims 1 to 6 inclusive wherein:

A, D, E, U, V and R^3 are hydrogen;

B is chosen from halogen and C_1 to C_6 haloalkyl;

R^1 and R^2 are both methyl;

W is the group $-\overset{O}{\overset{\|}{C}}-G$ wherein G is chosen from the group consisting of hydroxy, C_1 to C_6 alkoxy, C_2 to C_6 alkenyloxy, C_2 to C_6 alkynyloxy, C_1 to C_6 alkylthio,

C_1 to C_6 haloalkoxy and the group OM wherein M is an alkali metal ion;

X is oxygen;

m is 0, k and l are independently chosen from 0 and 1 and k+l+m is 0 or 1; and

n is 0.

8. A compound according to any one of claims 1 to 7 inclusive wherein:

A, D, E, U, V and R^3 are hydrogen;

B is chosen from bromine and chlorine;

R^1 and R^2 are both methyl;

W is the group $-\overset{O}{\overset{\|}{C}}-G$ wherein G is chosen from the group consisting of hydroxy, C_1 to C_6 alkoxy, allyloxy, C_2 to C_6 alkynyloxy, C_1 to C_6 alkylthio, C_1 to C_6 chloroalkoxy and the group OM wherein M is sodium or potassium;

X is oxygen;

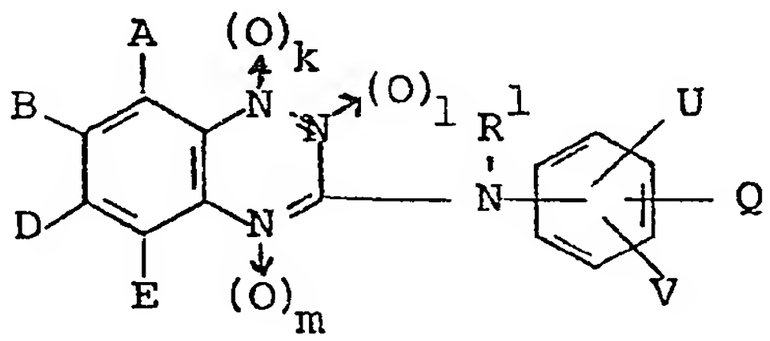
m is 0, k and l are independently chosen from 0 and 1 and k+l+m is 0 or 1; and

n is 0.

9. A compound according to any one of claims 1 to 8 inclusive chosen from the group consisting of the methyl, ethyl, n-propyl, isopropyl, n-butyl, isobutyl and secondarybutyl esters of 2-{4-[N-methyl-N-(7-chloro-1,2,4-benzotriazin-3-yl)amino]phenoxy}propionic acid, 2-{4-[N-methyl-N-(7-bromo-1,2,4-benzotriazin-3-yl)amino]-phenoxy}propionic acid, 2-{4-[N-methyl-N-(7-chloro-1-oxide-1,2,4-benzotriazin-3-yl)amino]phenoxy}propionic acid, 2-{4-[N-methyl-N-(7-bromo-1-oxide-1,2,4-benzotriazin-3-yl)amino]phenoxy}propionic acid, 2-{4-[N-methyl-N-(7-chloro-2-oxide-1,2,4-benzotriazin-3-yl)-

amino]phenoxy}propionic acid and 2-{4-[N-methyl-N-(7-bromo-2-oxide-1,2,4-benzotriazin-3-yl)amino]-phenoxy}propionic acid.

10. A compound of formula VIII



VIII

wherein A, B, D, E, R^1, U, V, k, l and m are as defined according to any one of claims 1 to 9 inclusive and Q is chosen from hydroxy, mercapto, C_1 to C_6 alkoxy and C_1 to C_6 alkylthio.

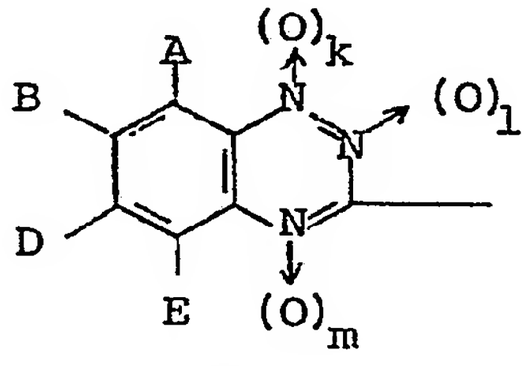
11. A herbicidal composition comprising as active ingredient a compound as defined according to any one of claims 1 to 9 inclusive and a carrier therefor.

12. A process for severely damaging or killing unwanted plants which process comprises applying to said plants, or to the growth medium of said plants, an effective amount of a compound as defined according to any one of claims 1 to 9 inclusive or an effective amount of a composition as defined according to claim 11.

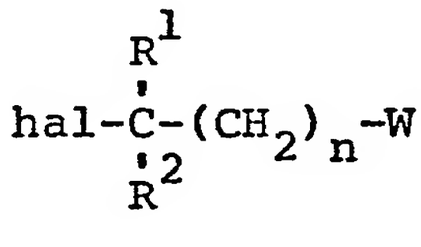
13. A process for selectively controlling the growth of monocotyledonous weeds in dicotyledonous crops which process comprises applying to said crop, or to the growth medium of said crop, a compound as defined according to any one of claims 1 to 9 inclusive or a composition as defined according to claim 11 in an amount sufficient to severely damage or kill the weeds but insufficient to substantially damage the crop.

14. A process according to claim 12 or claim 13 wherein the compound is applied at a rate in the range from 0.005 to 20 kilograms per hectare.

15. A process for the synthesis of a compound of formula I as defined according to any one of claims 1 to 9 inclusive which process comprises either the reaction of a benzotriazine derivative of formula IX with a compound of formula X wherein hal is chlorine, bromine or iodine

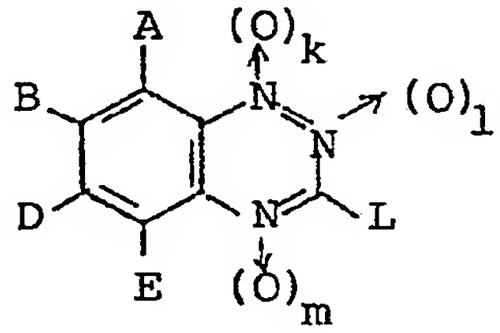


IX

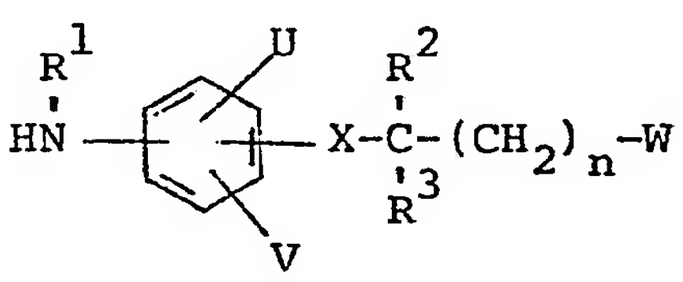


X

or the reaction of a benzotriazine derivative of formula V, wherein L is a leaving group, with a compound of formula VI

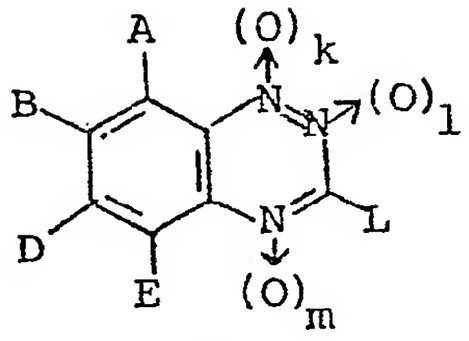


V



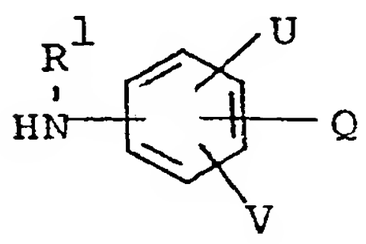
VI

16. A process according to claim 15 wherein the benzotriazine compound of formula IX is prepared by reacting a benzotriazine derivative of formula V, wherein L is a leaving group,



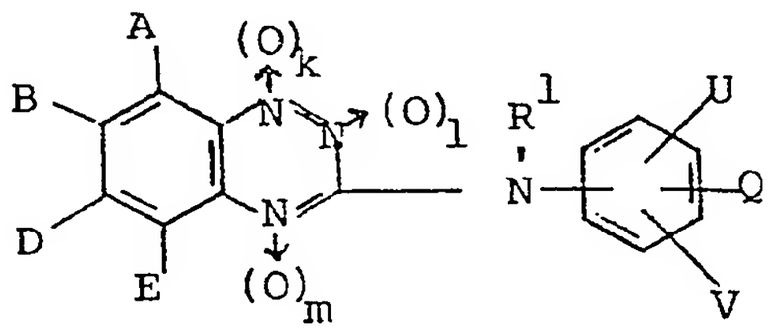
V

with an aniline derivative of formula VII, wherein Q is hydroxy, mercapto, C_1 to C_6 alkoxy or C_1 to C_6 alkylthio,



VII

to give a compound of formula VIII,



VIII

and, when Q is C_1 to C_6 alkoxy or C_1 to C_6 alkylthio, dealkylating the compound of formula VIII to give the compound of formula IX.

17. A compound of formula I as defined according to any one of claims 1 to 9 inclusive substantially as herein described with reference to any one of Examples 1 to 24 inclusive.

18. A composition as defined according to claim 11 substantially as herein described with reference to any one of Examples 25 to 29 inclusive.

19. A process as defined according to any one of claims 12 to 14 inclusive substantially as herein described with reference to any one of Examples 26 to 29 inclusive.

20. A process as defined according to claim 15 or claim 16 substantially as herein described with reference to any one of Examples 1 to 23 inclusive.

DATED ~~this~~ day ~~of~~ ~~1980~~

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